The Journal of THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

COMMONWEALTH MYCOLOGICAL INSTITUTE
4 OCT. 1948

VOL. 14 JUNE, 1948 No. 2

REGISTERED AT THE GENERAL POST OFFICE SYDNEY. FOR TRANSMISSION BY POST AS A PERIODICAL

SCIENCE AIDS WOOL

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In the Australian national economy, Wool is the greatest source of income. The Australian Wool Board is making every effort to make known to all wool growers and manufacturers methods of improving the quality of this primary product and the goods manufactured from it. The Board continues to offer its assistance to every organization whose aim it is to consolidate the position Wool occupies today. The extent to which it has already co-operated in extension work of all kinds is indicated by the following :

Films : The Board's own Film Unit has been active in the production of instructional films which have proved of immense value to growers. With the co-operation of State Departments of Agriculture, regular tours, during which free exhibitions are given, ensure that wool-growing districts in all States are visited.

Handbook for Growers : 40,000 growers to whom the "Handbook" was sent free of cost were quick to acknowledge its worth. This publication has been acclaimed as the most comprehensive and informative book of reference available. It has more than fulfilled the purpose for which it was produced — i.e., to make known to wool growers the latest developments in research work on the control of sheep diseases.

Research Subsidies : To further research affecting the sheep and wool industry, the Board since its formation in 1936 has made grants to the Council for Scientific and Industrial Research, the State Departments of Agriculture, the Waite Institute, and the Universities of Sydney and Western Australia. Included in these subsidies was a capital grant of £20,000 to establish a research station at Gilruth Plains, in Queensland.

Technical Research : Australian manufacturers are kept informed by the Board of develpoments in new methods designed to improve the manufacture of wool products.

In many ways, the Board gives valuable assistance to research workers. By promptly conveying the results of their investigations to woolgrowers and wool manufacturers, the Board is doing its utmost to help in the production of goods which will justify the slogan

There is no substitute for ***wool***

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The Journal of THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

Vol. 14 **No. 2**

JUNE, 1948

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Published Quarterly. *Annual Subscription Rate: Within Australia* 10/6, *British Countries* 11/6, *Foreign Countries* 12/6.

PRESIDENTIAL ADDRESS

AN END AND A BEGINNING

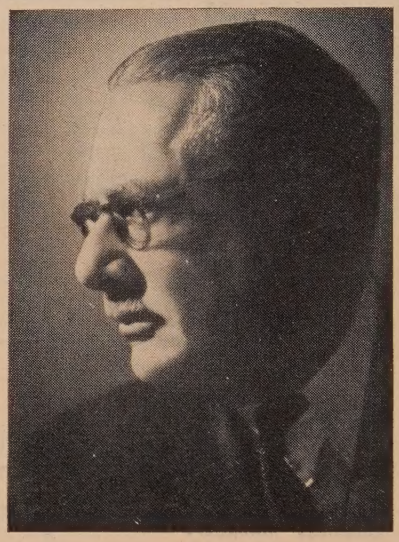
By G. DE VAHL DAVIS

Meeting on this 19th day of March, 1948, is there anyone present who can truthfully say that his mind is entirely free from doubt, apprehension or even fear, about the future? With the end of one war not yet three years removed, with the Peace Treaties, for what they may be worth, not yet even written, there is open talk—and it is neither idle nor irresponsible—of a new conflict which in its potential for human suffering, may far transcend anything that has ever gone before.

As adult members of the community with pretensions at least to an education, if not an intellectual capacity, somewhat higher than average, it is not fitting that we should immure ourselves in our laboratories and offices and close our eyes and our ears and our minds to the events of the day.

Like all other human activities, war has changed radically within the short period of written history. Formerly, man armed himself with spear and club and axe and went out openly to meet his foe: today we have enlisted and marshalled all the resources of science and industry to the end that death and destruction may rain upon remote lands and non-combatant populations. Even more than war itself, the motive for war has undergone revolutionary alteration.

When enunciating his Four Freedoms, Roosevelt made a serious endeavour to reduce to a formula the basic causes of war. With all the deference due to the memory of that talented man, I suggest that he might have carried his condensation even further. Freedom of Speech and Freedom for Worship are the sequels of peace; the mere possession of these blessings cannot, of itself, ensure peace. Remove Fear and Want and you will have a population disposed for peace. Can we go, perhaps, a little further? Would it not be true to say that in a world where



G. de Vahl Davis

all men were adequately supplied with food, clothing and shelter, the seeds of discontent and war would never germinate?

The Institute—A Corporation

This Institute, a corporation of scientific workers meeting to discuss problems of interest to all its members, has always properly stood aloof from politics, but it would be proper to say that the exponents of all political creeds, insofar as they are sincere, might agree with that last assumption. Your politician would, of course, assert that it is only through his own particular "ism" that the spectre of Want can be banished from the world. On this point, I am a confessed agnostic but I do know that if men of science, especially men of agricultural science, will pool their knowledge and co-ordinate

their efforts, they can help the world to produce more of its basic needs, the foods, the fats and the fibres.

To make so sweeping a statement without suggesting a means for its implementation would be as fatuous as to assert that any political formula could, of itself, produce the Brave New World. Where, then, can I turn for guidance in devising a policy directed to so vital an objective?

This Institute has, in the past, been guided by outstanding men of national eminence in the profession and also in many other fields of human endeavour. Each, at the end of his term of office, has issued a challenge directed, not so much to the individual members, but principally to the Institute as a whole. To the extent to which we have neglected these we have, I say, failed in our national and our international duty. To the extent to which we are now prepared to accept the challenge, we can claim to justify our existence. There must be an end of hesitancy, and end of the parish-pump policies and a beginning of a determination to assert, as is our right, our claim to leadership in our chosen profession.

Tonight, then, I propose to present a synthetic policy based upon those messages of yesterday and intended as a directive upon which the Institute of today and tomorrow can base its contribution to the conquest of want and, so, to the promotion of peace.

Dr. A. E. V. Richardson, foundation president, after a survey of the factors controlling and/or limiting supply and demand, suggested that the Institute investigate the twin problems of the maximum production capacity and the maximum possible population of the Commonwealth. **Professor S. M. Wadham,** next in line, examined the various main branches of agricultural industry with a view to assessing the extent to which, by investigation and intensification, production could, *economically,* be increased.

Professor R. D. Watt stressed the need for a rigorous overhauling of our agricultural education and for a closer co-ordination between various research establishments and between research and extension, if Australia were to play its part in helping to feed the post-war world. Largely the same topics were discussed, though from a different angle, by **Professor J. A. Prescott.**

Professor G. A. Currie, last of the wartime presidents, also looked toward the future and called for a new approach to education so that the whole nation would be trained to think in scientific terms of its future problems and yet might retain an appreciation of cultural value. **Dr. B. T. Dickson,** speaking in the "post-war period" gave detailed attention to those various branches of agricultural science which, through proper attention or neglect, might lead to prosperity or the reverse. His main plea was for regional planning and the closest possible co-ordination between research, extension and the farmer.

These various individual addresses, which have all appeared in the Journal, merit a careful re-reading in 1948. Alike in their general themes, they all sought to stress the need for team-work in the service of the nation. This was perhaps most strikingly expressed by **Professor Watt** (1939-40) when he spoke of the Institute as "enabling us to speak with a united voice, to pool our common knowledge and to co-operate . . . as members of a united team with a consequent increase in our capacity for useful service to the community." . . . "The future of this great Commonwealth lies largely in our hands . . . this trusteeship is at once a great privilege and an enormous responsibility."

A SYNTHESIS

Thus, directly or by implication, each of our past Presidents contributed something to an indictment of the Institute for its sins of omission or, to be more positive, indicated just what should be done to improve agricultural production in Australia. It was with no selfish motive

that they asked us to work but rather that we might contribute more towards feeding and clothing a world lacking in these basic needs. That the effort would, simultaneously, add to the prosperity of our industry and our nation is not an unworthy complement, nor would it be improper if, as a result of our efforts, the Institute should grow in prestige and its members be afforded more adequate recognition and reward.

In the hope that the challenge may, even now, be accepted, I have ventured to condense and combine the various ideas which fall into a series of four distinct questions:—

Education

Are the existing systems of agricultural education satisfactory? Should some measure of agricultural training be included in the curriculum of all schools? How can the system of training at the Agricultural Colleges be improved? Can we make better use of our University Schools by co-ordination (not necessarily standardisation) of the curricula and by planning for interchange of post-graduate students?

Research and Extension

Have we achieved the maximum degree of co-ordination amongst the various institutions engaged in agricultural research? Are more research centres needed? Is there a close enough tie between the laboratory and the field? Are the conditions of employment in the profession sufficiently attractive to secure and hold the best human material available?

Land Utilisation

Are we aiming, positively, at maximum production by the optimum utilisation of our land resources? Have we a master plan for regional land use? Have we presented the people of Australia with an overall picture of the use that could be made of all the agro-climatic zones of the Commonwealth?

Production

Are we sufficiently familiar with all the problems limiting production in every major branch of Agriculture practised in Australia? To the extent that we do recognise such factors, what steps are we taking to see that proper attention, by regulation if necessary, is given to their correction?

If, as I hope, the Institute chooses to undertake the examination of these questions, then there will be need for four central committees, with corresponding sub-committees within each of the Branches. It would, I suggest, be desirable that interim reports be constantly exchanged between the various committees and, for this purpose, a central Project Committee might be useful.

It may be said—and rightly said, that all of this would make some demand upon the leisure time of Institute members. To this I would reply that the said members would be sadly lacking in corporate spirit if they feel that they have done their duty by paying a subscription after which they can leave the rest to their Branch Committees and to Council.

Only by an Institute-wide recognition of our responsibilities and our opportunities can we hope to attain this goal. Are we big enough to make the effort?

Mr. G. de Vahl Davis, immediate past president of the Australian Institute of Agricultural Science, was born Melbourne, April, 1897, *early education Perth and Sydney. Entered Sydney University* 1915, *enlisted* 1916. *Served Egypt and Palestine as signaller, 6th A.L.H. Wounded* 1918, *re-entered Sydney University April* 1919 *whilst still in military hospital. Graduated B.Sc. Agr. (Hons. II) in* 1921.

Entered N.S.W. Department of Agriculture, but resigned on purchasing a wheat and sheep farm near Junee (N.S.W.). In 1924 *suffered a recurrence of war-time disability and returned to Sydney. Became Bacteriologist and later Sales Manager of Davis Gelatine Ltd. In* 1929, *whilst in Europe, appointed to represent the Franco-German potash producers in Australia and New Zealand. Attended Soil Science Congress at Oxford in* 1935, *and International Agricultural Science Congress at Dresden in* 1939. *Enlisted in* 1941 *and served for two years as Captain in Australian Signal Service.*

Was President of Sydney University Agricultural Graduates Association in 1933, *and was active in the formation of this Institute in* 1935. *President of N.S.W. Branch* 1937/8.

ARTICLES

THE DEVELOPMENT OF AGRICULTURAL RESOURCES

By A. F. BELL

President of the Australian Institute of Agricultural Science

It is apparent that the full development of Australia must be based essentially on agriculture, with the economic standard of life dependent upon the degree of prosperity and permanence of that agriculture.

The development of the agricultural resources of a country is a complex problem requiring, for its proper solution, a joint approach not only by agricultural, land, and irrigation authorities, but also by those directing the development of transport, regional planning, and the provision of amenities. Unfortunately any such joint approach has usually been conspicuous by its absence in the development of agriculture (in its broadest sense) in Australia: Rail and road development have frequently determined land settlement rather than the reverse; land has been thrown open for selection without due regard to its fertility or erodability, or to the necessity for the provision of timber reserves; and so on. The result has been a generally inefficient land utilisation, with expediency rather than permancy as a frequent dominating influence.

It must be freely admitted that the deficiencies in policy cannot be glibly attributed entirely to shortsightedness and lack of co-ordination; what was done was often that which appeared to be best in the existing state of knowledge. It is also true, however, that the basic agricultural development of Australia is very far from complete; not only is there a responsibility to rectify, as far as possible, the mistakes of the past but there is ample scope for the fostering of rational development in the future. Indeed, inasmuch as a great proportion of the country now awaiting development is "marginal" country, the necessity for a co-ordinated approach to the problem is possibly greater than ever before.

Co-ordination Desirable

One of the legacies of wartime regimentation is that the terms "co-ordination" and "committee" have become an anathema to most people. Undoubtedly we have had, and still have, a surfeit of co-ordinating committees. Yet none will deny that a full measure of co-ordination is desirable at all times, and it would seem that we have fallen into the error of trying to co-ordinate too many activities piecemeal, and in too great detail, rather than seeking to co-ordinate policy and principle.

An interesting and profitable example of simplified co-ordination has been instituted in Queensland under the provisions of "The Land and Water Resources Development Act of 1943." In terms of this Act there has been set up a Bureau of Investigation with the following personnel: The Co-ordinator-General of Public Works and Commissioner for Main Roads; the Under Secretary for Agriculture; the Commissioner for Irrigation; a Member of the State Electricity Commission; and an Executive Officer from the Department of Public Lands.

Since the forestry and soil conservation services are sub-departments of the De-

partments of Lands and Agriculture, respectively, this representation provides for the formulation at high level of co-ordinated policies of land utilisation and access, and for the conservation of resources. (Railways and roads are, for example, the greatest concentrators and diverters of water flow and hence influence tremendously the problem of soil erosion and water conservation.) The Bureau maintains a very small staff for the compilation and collation of data and reports, its main function being the co-ordination of Departmental approach to problems of direct or indirect mutual concern. It has achieved a large measure of co-ordination and elminated the necessity for minor committees.

Queensland Example

As an example of a co-ordinated and rapidly implemented investigation may be cited the current investigation of the irrigation potentialities of the Burdekin River basin in North Queensland. Members of the Bureau visited the area and made a preliminary assessment of the proposal which, on the surface, appeared attractive. This was followed within a few weeks by reconnaissance surveys conducted by the Main Roads Commission, the Department of Agriculture, and the Stanley River Works Board; these surveys were designed to furnish a reasonable overall picture of the quantity of water available, the order of the capacity of dams of different heights, the topography of the land, the probable suitability of the soil for irrigation, and the relation of water storage to flood mitigation and electricity generation.

A report based on this preliminary investigation was favourably considered by the Government and the Bureau immediately arranged for a simultaneous and detailed examination of the whole proposal. In these investigations, now in progress, special features are being examined by the Irrigation Commission, the Main Roads Commission, Department of Agriculture, Lands Department (the land in question is Crown land), Electricity Commission (supply and generation of power), Stanley River Works Board (hydrology and boring at the dam site), as well as the Bureau's technical officers. An irrigation research station has been opened and the C.S.I.R. has a soil survey team on the job.

By this method of approach the proposal is being treated as a whole and the final determination of the practicability of the scheme will be based on complete knowledge, obtained in the minimum of time.

Workers in the field of agricultural science should not only master the problems of their specific field of endeavour, but should at the same time develop an outlook much broader than that covered by agricultural science, and, moreover, help to stimulate a similar outlook on the part of leaders in other spheres. The Institute is well fitted to play an important part in fostering this ideal.

His Majesty's Colonial Service

Applications are invited for a vacancy for an Animal Husbandry Officer in Fiji, to undertake investigational work on animal production, breeding, nutrition and the management of livestock. Qualifications required are an approved degree in Agriculture or Veterinary Science, with some post-graduate specialisation in Animal Husbandry.

The post is on agreement for two years in the first instance, but may become permanent and pensionable later. The salary is in the scale of £F500 for three years, £F575 x £F25—£F600 x £F30—£F720 x £F30—£F840 x £40—£F900 (£F111 = £100 sterling). Starting salary will depend upon previous experience and War Service of the selected candidate. Free first class passages are provided for the officer and his family (not exceeding 4 adult fares in all) on appointment and on conclusion of the agreement. Applicants should have been borne on or after 1st January, 1908.

Application forms may be obtained from:

Professor S. M. Wadham,
Colonial Appointments Committee,
University of Melbourne,
Melbourne, N. 3.

DAIRY RESEARCH AND AUSTRALIAN PROGRESS

By R. K. MORTON

The Australian dairy industry has entered a new and vital phase in its development. The present low economic efficiency cannot be maintained in the face of increasing world competition. This has recently been stressed by the Rural Reconstruction Commission[18] which has also pointed out the need for re-organisation of the industry.

The methods by which the overall efficiency may be raised are thus of immediate and topical interest. They appear to be of two kinds:—

1. Those which involve an immediate re-arrangement of factors within the industry, and which are largely controlled by the industry itself, and
2. Those which depend upon a better knowledge of the fundamental problems. The definition of the problems and their solution is the category of research, and this is not directly controlled by the dairy industry.

Methods of the first kind have already been discussed in this Journal by McDonald[11]. The need for extending the present inadequate research facilities, and the improvements which may result from application of modern research findings, are considered in this paper.

Overseas Research Institutions.

World dairy research centres are closely allied with agricultural research centres, colleges and universities. To enumerate all such institutes would be beyond the scope of this paper. It is pertinent, however, to mention those which are making major contributions to dairy science knowledge, particularly those of the British Commonwealth.

Britain possesses two major research organisations: the National Institute for Research in Dairying at Shinfield, near Reading, England, which is closely associated with the University of Reading, and the Hannah Dairy Research Institute, Kirkhill, Ayr, Scotland.

The Hannah Institute, adjacent to the West of Scotland Agricultural College, has connections with the University of Glasgow. In addition, many of the agricultural colleges have made noteworthy contributions in the applied fields, both individually and as co-operatives in investigations embracing the whole country. Among these colleges may be mentioned particularly the South-Eastern Agricultural College, Wye (recently incorporated in the University of London) and the University College of Wales, Aberystwyth. Cambridge University, active in many fields of agricultural science, has made particular study of the physiology of dairy cattle and has contributed much to our knowledge of refrigeration and low-temperature effects. The London School of Hygiene and Tropical Medicine, London University, is particularly active in the field of dairy bacteriology. Recently, it has been decided to establish a new Institute for Research in Animal Physiology and no doubt this Institute will pay particular attention to the physiology of the dairy cow.

New Zealand

Britain undoubtedly leads the British Commonwealth in the field of dairy research. Some of the Dominions, however, have made great strides in their dairying industries through their own research organisations. New Zealand stands pre-eminent among the Dominions in this regard. The Dairy Research Institute, Palmerston North, is closely associated with the Massey Agricultural College (University of New Zealand) which now

R. K. MORTON, H.D.D., is New South Wales Milk Board Research Fellow in the bacteriology of milk at the School of Agriculture, University of Sydney.

This paper is based on the author's Presidential Address to the Sydney University Agricultural Society, on April 2, 1948.

includes on the staff a Professor of Dairy Husbandry in addition to a Professor of Dairying. The Research Institute is incorporated within the Department of Scientific and Industrial Research. The Grass and Lands Division of this Department, associated with the general dairy research organisation, maintains several grassland research stations, while the Animal Research Division of the Department of Agriculture is responsible for corresponding animal research stations. The New Zealand Dairy Board is closely associated with the other organisations while pusuing its own investigations which are the basis of the Herd Improvement Plan.

Canada has also been active in dairy research, which is conducted by research sections of the Dominion and Provincial Departments of Agriculture and by the National Research Laboratories of the National Research Council, while at least two Canadian Universities have Professors of Dairying.

United States of America.

Consistent with her eminence in other fields of agricultural research, the United States of America has the greatest number of research workers in dairy science. The Department of Agriculture has an extensive research organisation under the Bureau of Dairy Industry. There appears to be considerable co-operation between the Bureau and the various State Agricultural experiment stations. The Division of Dairy Research Laboratories is a section of the Bureau, and conducts research largely in connection with processing and distributing of milk and milk products. In addition, all major universities include dairy research under their agricultural research programmes. As in Britain, many of the large dairy companies conduct their own research programmes, the results of which are often promulgated publicly.

Denmark, Russia, Germany, France, Norway, and many other dairying countries are conducting, or have conducted, considerable research in the dairy science field. The direction which such research takes is often dependent upon the particular economic problems of the country, but, in all these countries, the progress within the dairy industries is closely associated with research development.

Research Organisation in Australia

Australia, as an important butter and cheese exporter and one particularly vital to the British Commonwealth, may well be expected to have a research organisation comparable with those of sister Dominions and other countries mentioned above. No such organisation at present exists, and it is the thesis of this paper that there is urgent need for establishment of an Australian research programme which will co-ordinate work done in each State.

The Dairy Research Section of the Council for Scientific and Industrial Research, has pursued some important aspects of Australian butter processing and distribution. The total amount of work of importance having origin at this Section, however, is not great, and must reflect the small size of the Section as compared with other branches of the C.S.I.R. The Division of Animal Health and Production, C.S.I.R. has included the investigation of some problems associated with dairy cattle in its programmes, but the emphasis of this Division has been upon sheep and beef cattle problems. The Queensland Department of Agriculture has a Dairy Research Branch which has published some work of considerable value to the local industry. It is understood that the Victorian Department of Agriculture has initiated a dairy research programme.

In New South Wales, the field of dairy research has been, until very recently, almost completely barren.

Sydney University has initiated research upon certain production problems at the McGarvie Smith Animal Hus-

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bandry Farm, Faculty of Veterinary Science, and upon some problems of dairy bacteriology at the Faculty of Agriculture. This work has been financially supported by the N.S.W. Milk Board.

The New South Wales Department of Agriculture, Division of Animal Industry, has a veterinary research station at Glenfield, and it is understood that a Dairy Research Officer is to be appointed to the Division of Dairying.

By comparison with other dairying countries, the total volume of research work having origin within Australia is lamentably small. Perhaps this is in some measure due to the lack of suitably trained research workers but primarily it must be due to the lack of suitable research institutions to employ such workers. There is little co-ordination of the work pursued in the several organisations mentioned above. The co-ordinating function of the Standing Committee of the Australian Agricultural Council has not so far been extended to dairy research.

REVIEW OF DAIRY RESEARCH

A very brief review of some of the major advances in dairy science in recent years is presented here to indicate the improvement in efficiency resulting from research work.

Milk Production

The problem of milk production does not commence with the cow but with crop and pasture which, in turn, depend upon soil and climate. The dairy farmer is thus faced with many of the general problems of agriculture before he meets particular problems associated with the cow as a milk-producing machine. Pasture research and efficient crop production are thus essential aspects of dairy research. These aspects, however, have largely been brought to notice elsewhere.

Perhaps the most important of recent advances has been the elucidation of the physiological mechanism controlling milk production and its release from the cow. Petersen[17] and his colleagues showed the importance of the hormone, oxytocin, reaching the udder within one minute of stimulation, in causing the "let-down" of milk. The association between this and other hormones concerned with lactation has been demonstrated, and the ultimate findings have not only explained fundamentals of milk production, but have had immediate application in the improvement of milking technique. These improvements have included the rapid milking of cows by machine (in less than four minutes), the abandonment of hand-stripping, the prevention of udder injury leading to mastitis, and the modification of milking machine design.

Other aspects of the physiology of milk production have been pursued in England, where the importance of thyroid extract in increasing milk production has been the subject of intensive investigation.[20] The feeding of iodinated protein has caused increases in yield of up to twenty-five per cent. The full application of these findings to commercial practice has yet to be elucidated.

The input-output relationships in milk production have been investigated both in Britain[22] and the United States.[10] This work has particular application to milk production for whole milk distribution, and has been used by Geddes to devise a simplified method for economic feeding. Improved yields at certain N.S.W. centres has been adequate illustration of the success of the method.

Closely allied to the above have been investigations of methods of increasing the protein level of the dairy cow ration. Urea has been successfully used as a protein-substitute, but the Hannah Dairy Research Institute, using farm-grown legumes, has demonstrated the possibility of achieving similar results by modification of normal farm methods.[6] Further

investigations of nutrition of dairy cows appear to be combined problems of agrostology and animal physiology. The microflora and fauna of the rumen has recently been demonstrated as of increased importance in the efficiency of utilisation of feeds and this has given considerable stimulus to the study of the microbiology of digestive processes in cattle.[16]

Breeding Improvements

Breeding improvements are necessarily long-term projects and hence new ideas are not likely to break suddenly into the research field. There has been recent emphasis, however, upon the inability to predict productive capacity from conformation of the dairy cow, and investigation has been directed towards finding a simple index by which to gauge this capacity. The investigation of the relationship between the size of the mammary glands at four months and productive capacity of the mature animal by Swett[19] apparently offers some hope of establishing such an index.

A much more fundamental approach to improvement of dairy cattle than hitherto has been adopted. The extension of the technique of artificial insemination to commercial application has been achieved through a considerable number of investigations in Britain, U.S.A. and New Zealand. Ward, using herd records to differentiate between factors in improved production, has shown the futility of basing any herd improvement programme upon production records of the dam.[14] Herd recording is considered essential for sire-surveys, and the extensive use of progeny-tested bulls (both naturally and by artificial insemination) is the basis of New Zealand herd-improvement methods.

The long-term breeding experiments of the U.S.D.A., conducted at Beltsville Station, have given valuable data concerning the possibility of improving production through two distinct approaches:

1. By selection for homozygosity for high milk and fat production, using carefully chosen progeny-tested bulls, and
2. By use of progeny-tested bulls and wide out-crossing.

The early indications are that there is little difference in the rate of improvement in productive ability from one generation to another, whether line-breeding or out-breeding is adopted.[7] At the same time data being collected on the effects of cross-breeding has so far favoured the view that the use of first-cross cows can further step up production. This experience has had some confirmation in Victoria.[8]

In Britain, emphasis has been on improvement of production through elimination of disease, particularly of mastitis. Davis has drawn attention to the enormous loss of milk solids through clinical and sub-clinical mastitis. He has recently devised a simple abnormality-detector which should be of value in locating subclinical mastitis.[5] The success of Strain 19 Vaccine for control of contagious abortion has been an important step in the improvement of production by elimination of disease.

Processing and Distribution

Investigations in dairy bacteriology have been pursued with renewed vigour in recent years, particularly in Britain. The stimulus largely came from the importance attached to milk as a wartime food. Improvement of production efficiency and diversion of milk from manufacture has been linked with a programme to ensure minimum loss of milk by deterioration. This programme, known as the National Milk Testing and Advisory Scheme, is dependent upon the resazurin test, used as a gauge of production conditions. The official method of the use of the dye resazurin was adopted as a result of investigations at a number of British research centres, this work being initiated and co-ordinated by the National Institute

at Reading. Work upon various dye tests is still being carried out in Britain[9] and this contrasts markedly with the recent attitude of investigators in U.S.A., who have rejected dye tests for routine purposes.[1] Modifications necessary for the improvement of dye tests for Australian conditions has been the subject of recent investigations. Smythe had made an excellent contribution in Queensland and work is still in progress in N.S.W.[13]

Butter Manufacture

The Allied occupation of Germany revealed that Germany had adopted a completely revolutionary system of butter manufacture, and had used it commercially at several centres during the war.[2] This system had origin from research conducted at the University of Kiel and at the Dairy Institute of Freising, Weihenstephan. While the system was designed to manufacture butter directly from milk, certain of the commercial machines can be adapted to use cream as the raw product. Investigations are taking place, or will take place, in all dairying countries, including Australia, to determine the relative advantages of the new continuous method as compared with the present standard method. It is possible that modifications of the German system may become universal for butter manufacture.

Improved methods for the manufacture of powdered whole milk, which is of increasing importance as a dairy product, will no doubt result from investigations carried out at the Hannah Dairy Research Institute. These investigations have been concerned with prevention of fat and protein deterioration, largely by control of the bacterial flora.[9]

The Need for Expansion of Research

Ward has placed emphasis upon the need for improved production methods. In a recent address ,[21] he stated that "We have at reasonable estimate, a three- to five-year breathing space in which to set about achieving the maximum efficiency that is possible in the dairying industry; and that is just as important in Australia as it is in New Zealand. It is just as important in Denmark as it is in Canada. In all those countries the dairying industry and research authorities are taking very active steps at present to bring about maximum efficiency in dairy production in as short a space of time as possible." The importance to Australia may be gauged from a comparison of production efficiency with that of New Zealand. McMeakin[12] has shown that the New Zealand average of 4,500 lb.-6,700 lb. butterfat per male labour unit exceeds that of any other country. The average production of 300 lb. commercial butter per cow[15] contrasts with the average of 170 lb. for Australia and 150 lb. for New South Wales.[4]

The economic necessity for increased efficiency within the Australian dairy industry has also been stressed by the Rural Reconstruction Commission. The Commission[18] has concluded that "It would be idle to assume that the Australian dairy industry can expect the present relatively high prices for its products to continue for long in the post-war period, or that it will take kindly to any fall in prices. The industry has for twenty years depended on assistance, in one form or another, from the nation. . . Reorganisation of a somewhat radical nature is overdue. . . If the industry is not prepared to face that reorganisation it should be allowed to find its own level, which would mean the transference of dairy farms in some districts to cattle raising or mixed agriculture."

While emphasis has been made upon the necessity for improvement of production efficiency, it is also clear that there is equal need for improvement in processing and distribution. There is little doubt that many of the changes in processing adopted in Australia in recent years have led to improved quality products and decreased costs. Most of these improvements have resulted from the adoption of machinery designed overseas,

if not constructed overseas. However, it is considered that there are still many avenues to be explored before Australian processing can be considered adequate. The reduction of loss by wastage must surely represent one of the major problems confronting any dairy produce factory. It is a problem to which no adequate answer has been found. As indicated by McDonald,[11] there is urgent need for prevention of the annual loss of milk solids as skim-milk, butter-milk and whey.

There is often inter-action between the methods of production and of processing and distribution. Thus change of breed type, of soil treatment, or of feeding methods to achieve increased production may cause a decline in the efficiency of processing and distribution. A research programme must consider such inter-action, and improvement of over-all efficiency of the industry should be the aim of investigations.

It is clear that the reorganisation of the Australian industry must include the application of recent research findings. There are many obstacles, however, in the path of those who seek to apply results of overseas research. These obstacles do not all arise from ignorance and prejudice. In many cases, conditions faced by the Australian dairy farmer differ markedly from those confronting the producer in other countries. There is need for research on methods of using the fundamental and applied knowledge already existing, as well as for research to elucidate further knowledge.

A SCHEME FOR RESEARCH CO-ORDINATION

Already some effort has been made within the Australian industry to meet the need for greater efficiency. The report of the New Zealand research workers to the Australian Agricultural Council, Committee on Animal Production, should be most valuable. There has also been established a Joint Dairying Industry Advisory Committee, to advise the Commonwealth Government upon matters related to production costs and efficiency levels. This Committee has recently completed an examination of the cost of butter production. Plans have been completed for a new dairy products factory (estimated cost £50,000) at Hawkesbury Agricultural College, Richmond, New South Wales, for improved instruction of factory operatives.

There has been no adequate move, however, to meet the most urgent need of the dairy industry—the need for a co-ordinated research programme. It is considered that the industry should initiate such a programme and that the universities of Australia should commence to train personnel to staff research centres.

It is therefore proposed that existing research facilities be used to build an expanding research scheme, the initial cost of which should be borne considerably by the industry that will benefit by it, and the expansion and maintenance be a charge upon the nation as a whole. It is understood that the Commonwealth Government is to allocate £250,000 per annum for the next five years for improvement of production efficiency.[3] A considerable portion of this money should be utilised directly for research purposes.

Role of the Universities

It is desirable, particularly in a complex industry such as the dairying industry, that research should be entirely free of any undue pressure of vested interests. Therefore, the research should primarily be entrusted to the Australian Universities, traditionally independent organisations, where these prove willing to co-operate in such an enterprise. In the initial stages co-ordination should be carried out by a national body such as the Australian Agricultural Council, Standing Committee on Agriculture, but later one university should be entrusted with prime

responsibility for co-ordination of the research scheme. This would be facilitated if the same university had attached to it a Dairy Research Institute the object clearly being to co-ordinate rather than to centralise investigations. Where research has already been initiated to meet local problems, this should be expanded by additional grants to the institutes responsible. The Research Institute should be charged with the responsibility of initiating research into urgent problems requiring immediate attention and this should be commenced where facilities and personnel are found to be most suitable. Work of a fundamental nature should be pursued at the Research Institute, the further investigations being conducted at other centres, in order to study application on a local basis.

Need for Trained Personnel

The availability of adequately trained personnel to staff such a Research Scheme is an immediate problem. If the research is entrusted to the universities, however, more trained personnel would become available with expansion of the scheme, since the teaching within any university often reflects its research interests. The extension of research and the improvement of training at the university level requires the support of improved training at the farmer and operative level. It is at this level that the agricultural colleges may be expected to co-operate in the proposed scheme. Plans for instructional factories, such as that to be erected at Hawkesbury Agricultural College, should, therefore, be delayed and possibly modified to enable these factories to co-operate in research investigations.

Role of the C.S.I.R.

Some consideration of the role of the Australian Council for Scientific and Industrial Research in relation to this scheme is necessary. Many are no doubt aware of the expansion of research and reorganisation of the Australian wool industry which is being pursued by the Council. There is no doubt of the excellence of the work of the many Divisions of this organisation. It is nevertheless true that, in many cases, the employment by the C.S.I.R. of University graduates has denuded Australian universities of personnel essential for the adequate training of future graduates. While perhaps meeting the immediate national needs better, it may well be questioned whether such continued pressing of first-quality scientists into research work without associated teaching facilities is not contrary to the ultimate national interests.

It is therefore considered that the Dairy Research Section of the C.S.I.R. should maintain its identity but should co-operate with the Research Scheme, continuing as at present its emphasis upon chemical problems of dairy products. The research facilities of the Division of Animal Industry, C.S.I.R., could no doubt be utilised, to further the scheme by co-operation, initiated, if necessary, by the Australian Agricultural Council. It is hoped that the placing of final responsibility for co-ordination with a national body, such as the Australian Agricultural Council, may be the means of circumventing such barriers as State jealousies, so often the doom-bell of many well-founded schemes.

The above scheme is purely a tentative proposal to stimulate some thought as to the most suitable method of meeting the urgent need for expansion of research in dairying. It is not claimed that it is perfect, but on the surface, at least, it appears a logical method and one involving the minimum cost to the dairying industry and to Australia. The scheme arose from a consideration of the inadequacy of research facilities in Australia for dairy science. This inadequacy is important to all agricultural scientists, and particularly to present and future students.

The Australian dairy industry must be maintained and expanded, and this process will undoubtedly call for adequately trained graduates. The dairy industry

must make open avenues for graduate employment, particularly in research. At the same time agricultural faculties of Australian universities must be aware of future trends and must modify teaching, if necessary, to meet these trends. The active appreciation of the problems and needs of the Australian dairy industry by agricultural scientists will do much to alleviate the growing pains which will undoubtedly occur in this reorganisation process.

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(*Received for Publication* 21*st May*, 1948.)

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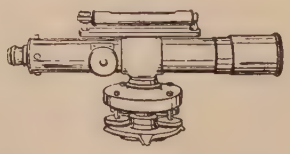

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NICOTIANA RUSTICA AS AN AUSTRALIAN FIELD CROP

By B. HOROWITZ, R. D. CROLL and T. C. BELL

Introduction

Nicotine sulphate has long been recognised as one of the most useful horticultural insecticides and veterinary vermifuges. Serious competitors to it are of recent origin and their place in the economy of pest control has yet to be fully established.

Australia had always relied on overseas sources for the bulk of her nicotine sulphate except for some small local manufacture from waste tobacco. The major suppliers of the world's nicotine sulphate before the last war were the United States, and certain European countries. The war, of course, left the United States as the only major source of supply to Australia and the allies, and despite a large reservoir of stocks, strict rationing had to be enforced. Use for veterinary purposes was not permitted since phenothiazine was an effective alternative drench. Horticultural usage was carefully controlled, and so low did stocks fall after hostilities had ceased that Australia faced the possibility of horticultural production without nicotine sulphate, a situation whose seriousness needs no stressing.

However, since 1942, research under Professor Ashby, of the University of Sydney, had established the possibility of using *Nicotiana rustica* as raw material for nicotine extraction. This research carried out by Dr. B. Horowitz at that time Research Fellow of the Sydney University resulted in determining the optimal cultivation conditions of this species in Australia, in selecting the most suitable districts and in developing new improved strains of *Nicotiana rustica* with a high content of nicotine and heavy yield per acre. Dr. Horowitz later organised the commercial production of Nicotiana rustica for a private firm. At the request of the Department of Commerce and Agriculture, the firm undertook large-scale field production of *Nicotiana rustica* in Australia, and the manufacture of nicotine sulphate from it.

Sufficient developmental work, both in the field and in the factory and laboratories, had been done to enable an immediate start to be made, and a major campaign was begun in 1946 to secure a large acreage, growing under a contract arrangement with the firm. A considerable output of the insecticide has since been achieved, making a significant contribution to insecticide stocks during a critical period.

The Basis of Contract

The source of the alkaloid *Nicotiana rustica,* was a crop new in many of its requirements to Australian farmers, and a brief account of the establishment of this industry may be of interest.

As the crop is more like tobacco than any comparable plant grown in Australia, the contract agreement with growers was drafted with this in mind, but with the conception of grades omitted. Ideally, the produce should be purchased on the basis of its alkaloid content. This is a function of many factors, some of which are not within the grower's control although thorough performance of all cultural operations recommended greatly influences the percentage of Nicotine. It would, therefore, be fair to purchase on such a basis. However, after much consideration, this policy was not adopted in

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view of several points; it would not be desirable to delay payments until assays had been done, and the mechanism for carrying out multiple assays would take time to establish and prove difficult to staff. Also it was felt that growers would be suspicious of an arrangement whereby their returns would be based on mystic chemical rites to determine an invisible, and intangible, criterion of quality. It was, therefore, decided to offer a flat rate per pound for the whole plant grown and dried according to the Company's instructions, and conforming to a specification of easily observable requirements. This meant, of course, that the Company concerned had to assume most of the risk on the score of variability of nicotine percentage.

Nicotiana rustica in the field is similar in many respects to *Nicotiana tabacum*, but requires a somewhat different cultural technique. It is not harvested in several stages, as is tobacco, but the stalk is split down, cut off at the base, and the whole plant is dried either in the air under cover, or in a tobacco kiln. The fact that the stalk, as well as the leaf, is bought, made a price of 9d. per pound for the whole dried plant seem a very good proposition as compared to other crops grown in areas in which it was desired to establish rustica.

The Growers' Reaction

The fact that growers were guaranteed a market for material grown in conformity with the Company's specification was also expected to make the obtaining of contracts a fairly simple matter. Actually, the conservatism of many growers outweighed not only these factors, but also the appeal that this project would assist Australia's vegetable growers, many of whom could be numbered amongst growers of rustica. It was presented as a nationally desirable job to be done, but unfortunately an understandable reserve, which prevented them from investing money in a crop unknown to them, and presented to them by a private enterprise, caused many to restrict acreage until it was almost negligible in the farmer's economy. Neglect then caused it to become unprofitable to them, and also to the Company, which still had to provide field service in widely dispersed districts, each of low production capacity.

This factor in establishment, namely, the cost of providing a complete extension service in the first year or two of a new undertaking is worthy of great emphasis. It is vital to obtain large quantities of raw material, as, when capital outlay is heavy, manufacture is profitable only when throughput is large. To obtain the acreage necessary to give a reasonable expectation of quantity harvested, allowing for seasonal losses, inevitably means the canvassing of many districts often widely separated. In many instances those areas in which it is suspected the growing of the crop may ultimately become popular are preoccupied with other highly paying projects. At the time of this campaign the shortage of labour, and the difficulties in obtaining materials with which to build drying sheds and kilns also severely limited the areas in which we could operate.

Crop Requirements

To understand the reasons for the behaviour of the crop in its various environments it is necessary to know requirements. Early sowing of seed in beds covered until germination has commenced is always desirable, and planting out of seedlings which have not been held back in their development is essential if good vegetative growth is to occur. The most seriously adverse thing which can happen to rustica is that it should receive a setback at any stage of its growth. Should this happen the reaction is immediately to go to flower, and to expend even more energy on the production of lateral or "sucker" growths at the expense of the development of the main stem and leaves. Given good conditions a large number of main leaves can be maintained, but for their formation and development an un-

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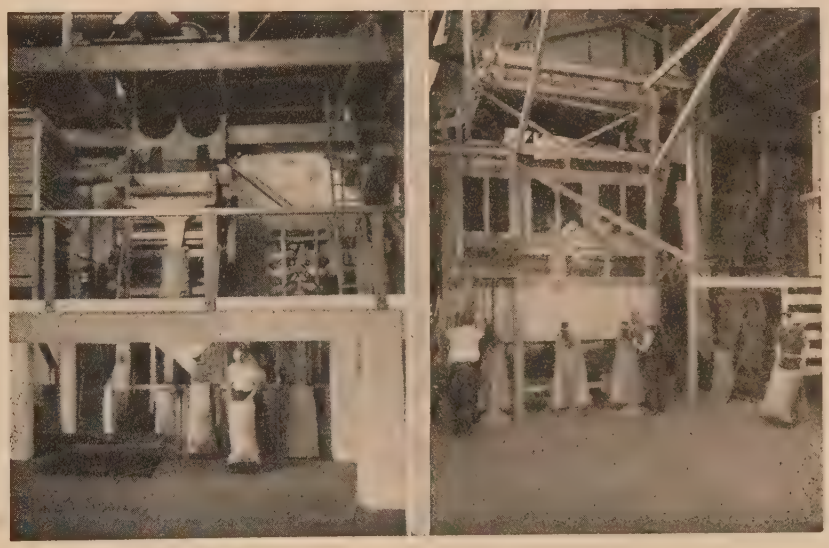

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checked growing period is necessary. High nitrogen, combined with consistently favourable growing conditions, prolongs the vegetative growth, so that the plant may achieve a height of 3 to 6 feet before being topped. The development of laterals within the axils of the main leaves will continue, however, and these must be removed before they reach a length of more than 3 in. or 4 in. It is this operation, which must be repeated 3 or 4 times, sometimes more, and the topping which consists of removing the central flower young bud with 3 or 4 of the topmost leaves, that results in a high cost of production. Similarly, the labour requirements per acre during the

Fig.1.—A well tended bed of Nicotiana rustica seedlings near Wangaratta (Vic.), ready for transplanting. Calico covers are thrown off during the day.

time at which suckers and tops have to be removed mean that one man can only handle 3 acres efficiently, if he has some other work to do; or if he spends his full time on it and has had experience beforehand, 4 acres is sufficient. "With an assistant during this busiest period the maximum handleable area could rise to about 6 or 7 acres under the climatic conditions of New South Wales and Victoria. In North Queensland there is a possibility of raising more than one crop per year. During a period of about 9 months 2 to 4 sowings carried out at 6-weekly intervals are possible. This enables a considerably larger area (possibly 10 acres) to be handled by one grower during this extended growing period by spreading the work.

Yields vary greatly from one district to another and with cultural treatment, but if they are less than 1 ton (2,000 lbs.) to the acre, can be considered poor. On the other hand, under good conditions over 5,000 lbs. per acre have been achieved, even under commercial conditions. With the prevailing prices of 9d. per lb. in 1946/1947, and 11d. per lb. in 1947/1948, it will be seen that the income from the labour of one man expended solely on *Nicotiana rustica* is not great, and indeed is usually not sufficient to persuade him to put aside other crops, even though they may be more risky. There is a chance of making considerably more money from 10 or 12 acres of a crop such as tobacco, than can be obtained from 4 acres of rustica, though it is the relative certainly of making some profit from the latter crop which makes it attractive.

Resistance to Diseases

During 1945, when extensive field trials were carried out, no disease was seen to affect yields significantly. It was obvious from this, and glasshouse work which had gone before, that the resistance of *Nicotiana rustica* is much greater to troubles such as blue mould, than smoking tobacco. Precautions were taken, however, in that stocks of benzol were located at growing centres for the treatment of seed beds if the disease should appear. This did not happen in 1946/1947, which was an excellent year from the point of view of growing both tobacco and rustica. In 1947/1948, however, the Ovens Valley experienced one of the worst blue mould years in its existence as a tobacco-growing community, and although far less damage was observed on rustica, it was still of sufficient extent to affect yields considerably. Necrotic areas which affect the appearance of smoking leaf are of no importance on rustica where manufacture into nicotine

Fig. 2.—"Suckering" accounts for the greater part of production costs. This half-grown crop is spaced too widely between rows.

sulphate is carried out, but the fungus invades the tissue of *Nicotiana rustica* just as it does Tabacum, and causes the same type of systemic breakdown. This constitutes the setback which, as has been mentioned, causes premature flowering and light yields.

As to the factors affecting alkaloid content it is known that apart from the genetic constitution of the variety, high levels of soil nutrients, particularly nitrogen, good physical structure of the soil, sufficient moisture, and the attainment of full physiological maturity of the leaf are the major factors. High soil fertility can be readily controlled in most instances by planting on fallow which has previously been under a leguminous crop, or by adding nitrogenous fertilisers. Some difficulty, however, was experienced because of the severe shortage of sulphate of ammonia. Thanks to the co-operation of fertiliser companies and controlling authorities, these difficulties were minimised and the only thing to be overcome then was the bias of farmers against applying nitrogen to a crop which they regarded as similar in nature to tobacco. In this connection it is worthy of note that unless a great deal of time could be given individually to each grower in which all the reasons for, and necessity of, applying nitrogen could be given orally, nothing would be done. Written instructions were given at the beginning of the season and contemporaneously when the operations should be done, but in a very large percentage of cases such written instructions were shelved without ever having been read. This in spite of insistence in the contract that obedience to instructions was mandatory for the payment of the contract price.

Ensuring that plants were not harvested until they were fully mature was made difficult by two considerations. The first, that identification of a mature plant is difficult in a leaf crop which is unfamiliar; the changes accompanying ripening are not marked, and are of degree rather than nature. Secondly, seasonal conditions in districts with high summer rainfall may cause "second growth" of the leaf and make it difficult to bring some varieties to maturity. This is the case in East Gippsland where the type known as "Variety 50" in the Company's classification is grown in preference to "Variety 51." The former is a more open type of plant, more upstanding in habit, which may yield less, but has a growing period about 2 weeks shorter than the latter. It is less inclined to "second growth."

The shed space requirements for drying have been stressed adequately, but in some areas high summer rainfall and humidity led to difficulty in thorough drying before the onset of cool autumn weather which is unsuitable for baling, owing to the danger of moulding in material with a high moisture content.

Farmers' Outlook

Outweighing all these considerations is that of the unwillingness of farmers in any particular district to try out some-

thing new when prices for other commodities are high and casual labour is scarce. A difficulty, too, is the availability of good friable soils in localities with irrigation or good summer rainfall.

Climatically, most of the agricultural areas north of the Victorian Dividing Range appear to be satisfactory. Further South difficulty is experienced in raising seedlings during the cold Spring. It is usually found that germination is delayed and growth in the seed bed is so slow that 10 or 12 weeks elapse before planting out can take place. These aged seedlings may still not get away quickly unless suitable weather follows. This was overcome during the two commercial years to a limited extent by raising seedlings, again under contract, in Northern Victoria and railing them in boxes in the same way that tobacco seedlings are transported. This, while better than planting out old seedlings, still gives the plants a big enough setback to affect their yield if the distances to be covered are large, or the time elapsing between lifting and planting out is long. It is considered that in several districts of N.S.W. and Victoria with a cold and late Spring, and a short vegetation period resulting from early frosts, success in growing *Nicotiana rustica* will largely depend on the possibility of raising seedlings in adjacent "earlier" and "warmer" districts wherefrom they would be dispatched for planting in the "colder" districts after the danger of frost is over.

As against these disadvantages it has been shown that adequate attention, even when considerable damage has apparently been done, can cause a nicotine crop to recover and carry on vegetative growth to produce good plants with high alkaloid content, but this is rather an exception.

It was immediately obvious that the centre of production would have to be in a tobacco growing area where previous experiments had proved that rustica could be grown satisfactorily, where drying facilities were on hand, and where growers had had experience with crops of a similar nature. Such men were less averse to undertaking production of a plant with a very high labour requirement, and with peculiar cultural needs. Drying facilities are rare in most areas of Victoria, and indeed in all States. It is widely recognised that most farms in the Eastern States are conspicuously deficient in shed space of all types, and many areas which had all the other requirements necessary for the growing of good rustica were ruled out because of this. So important was it that at one stage growing near the manufacturing centre and carting-in green was considered, either for immediate processing or for drying at a central station. The former was not feasible because manufacturing capacity must be enormous to cope with a large throughput for a short period, and overhead expenses become abnormally high; the latter is impractical, since it demands a large staff and big floor areas for drying during harvest time. Post-war shortage conditions influenced decisions such as these to a very large degree.

Fig. 3.—This crop at Markwood (Ovens Valley, Vic.) is nearing maturity. Note well spaced rows and heavy leaf growth.

A drive was conducted through the press, radio and other publicity media to bring the offer of contracts for unlimited areas to the notice of anyone in N.S.W. and Vic. willing to undertake the growing of rustica under the supervision of the Company. Simultaneously, field staff

Fig. 4.—After splitting the main stalk well down, the intact butt is cut off at ground level. Thus the whole plant is harvested.

toured both States and convened meetings with the help of individuals who had gained experience by experimental growing in previous seasons. Considerable assistance was given by some State Departments of Agriculture, who promised, and gave, full co-operation through their District Officers. This helped enormously, as most growers are able to overcome their conservatism to a great extent if a new venture is introduced to them by someone whom they know, and in whom they have confidence. The Company's field staff, although known to a few growers, had not the advantage of being widely known through other activities. Each found it necessary first to gain the confidence of growers in himself and the Company, and then to convince them of the value of the proposition.

Although the publicity effort bore fruit in that a much larger number of growers, and probably far greater acreage, was achieved than could have been done solely through personal contact, it had its disadvantages. There is always a fair proportion of cranks who will try anything once, and a great deal of time and money is wasted in visiting the properties idle or insincere enquirers. For this and other reasons it is desirable to consider the first year of such a project as this as being experimental, so that field staff can travel without regard to the cost per pound of product involved in field service and establishment of new areas. Exploratory work before commencing commercial production is costly, but undoubtedly pays in the long run.

Victoria

In Victoria, the Ovens and King Valleys, including the area round Wangaratta, were considered the most promising, both from the point of view of gaining contracted acreage and harvesting high quality material. This proved to be largely correct, but in the Ovens Valley soil conditions are not completely suitable for rustica. Far too many growers have no choice but to grow on low fertility, sandy soils sometimes of poor texture. Low fertility is often due to their holdings having long been cropped to tobacco, and deliberately depleted in nitrogen, enabling light leaf to be produced for smoking. These conditions caused *Nicotiana rustica* to yield poorly and produce papery textured plants with a low alkaloid content. For the production of high yielding crops the physical state of the soil appears to be of major importance; many holdings in the Ovens Valley lack friable soils, and, on ground which packs, the root-binding which often follows transplanting in rainy weather causes stunting of plants, followed by early flowering.

The King Valley, on the other hand, in which the heavier types of tobacco were formerly grown, has ideal climatic

and soil conditions. Unfortunately, many of the curing barns fell into disrepair, or were dismantled when materials were scarce. Dairying has largely superseded cropping, and good returns are being obtained. It is, of course, practically impossible to persuade a dairy farmer to plough under well established pasture for the planting of an annual crop from which returns are still, to him, a matter for conjecture.

Other valleys in North-eastern Victoria could have been adopted had competitive crops not been returning such good profits. Broom millet, dairying and other pursuits were giving the farmers all the income they required, and there was no incentive to invest capital in sheds for drying nicotine when the future was uncertain. The Company could guarantee no continuity in contracting, nor satisfactory yields per acre in districts other than those mentioned.

On general considerations, Gippsland appeared to be the next best Victorian area, but the whole of South-eastern Victoria is deficient in farm buildings with the exception of Orbost, where a few very large bean drying sheds have been erected. There again, certified bean seed, green beans for the Sydney or Melbourne markets, and dairying have made it extremely difficult to introduce competition, and only a few of the more adventurous spirits could be tempted to plant small areas. Maffra, Bruthen and Koo-wee-rup swamp all have soil conditions well suited to this summer crop, but suffer from the disadvantages of lack of shed space, and of labour, and yield good returns from other projects. Little interest was shown there, but those who could irrigate could have made rustica growing profitable. Maize cropping at Bruthen was an insurmountable obstacle. Koo-wee-rup growers, however, showed some interest in the crop, and might have overcome the disadvantages of dry farming with a sharply declining rainfall during the vital growing period of the crop had other factors been in their favour.

Virus Disease

In spite of the lack of drying accommodation, it is safe to surmise that expansion might have occurred had not a virus disease, probably potato leaf roll, caused a serious decline in the growth and health of rustica about midway through the season. The plants showed typical symptoms of virus infection, the topmost leaves becoming crinkled and dwarfed. This was accompanied by the appearance of premature flower-heads, and a cessation of further vegetative growth. The danger of this occurring had, of course, been recognised, and a general recommendation had been made to avoid planting out rustica on areas which had grown other Solanaceous crops during the past few seasons.

In this case, as in most districts, disadvantages were known in advance, although their relative importance was not, but it was impossible economically to restrict growing to areas in which certain yields could be obtained. Contract growers were warned of these factors, and most of them approached the job in an experimental frame of mind during the 1946/1947 season, though a few were convinced that they were about to make their fortune, and endeavoured to grow far more than they could economically handle. In one or two instances requests were received for a contract to cover fifteen or twenty acres, based on a forlorn hope that labour might become available at and after Christmas time when the main manual work is done on the crop. With this attitude should be contrasted the Company's recommendation that one man should not attempt to look after more than 4 acres in the busy part of the season. Where large areas were granted to one grower it almost inevitably transpired that he harvested less, both per acre and in total quantity, than those who merely undertook an area which could be handled efficiently.

As growing had to be concentrated mainly in irrigation areas, an attempt was made to establish sufficient small

plots in the Shepparton area, particularly in Shepparton East as an evaluation for future plantings. The cost of field service for this experiment could be carried owing to the proximity of this district to the major growing centre of Myrtleford. This was almost the only other suitable place in the State where growers had experience in handling tobacco, and had some drying facilities. In that season almost every crop in the Shepparton district was a total failure, the reasons varying between farms, but usually due to lack of attention, planting too late, too infrequent irrigation, or planting on soil which had been worked to a degree where its physical structure had deteriorated. This last factor is, in our opinion, at least as important as any other single factor, such as fertility or climate, in its effect on the vegetative growth of *Nicotiana rustica*.

Although a number of smaller plantings were made, scattered throughout the Northern, Central and Metropolitan districts of Victoria, these were too small in extent to be worth describing.

New South Wales

In New South Wales it was known from past experience that the Tumut Valley was eminently suitable, and probably the only district in that State where dry farming practices would be satisfactory. Even here irrigation would prove a most desirable adjunct to a rustica grower, but, as is the case in Orbost, few growers there feel that the insurance value of having irrigation is worth the capital cost of installing equipment. A co-operative broom factory had also recently been started in Tumut, and top prices were being received for millet raised in that area. It was obvious, therefore, that many difficulties had to be overcome, and without information from previous experiments to prove the claim that high yields could be obtained, little success could have been expected.

Experimental plots had also been grown at Bathurst where vegetable growers found that they could handle the crop as a complement to their normal routine. Very high yields were obtained in these experiments, and in spite of the short growing season, it was found that most factors were in its favour. Comparatively late sowing of seed in covered beds enabled seedlings to be raised quickly and planted out late relative to other parts of New South Wales, but at a time when most Victorians were transplanting. The danger, of course, was that early autumn frosts might cut the nicotine before it was mature. Within the limits of available labour and shed space, this could be expanded into a useful production centre, and the very important requirements of a sympathetic attitude by growers, and a good type of grower being available, could both be satisfied.

Fig. 5.—Wilting before carting-in and hanging is essential.

At Tamworth, on the other hand, these two factors were working against the establishment of the crop, as those who had previously grown tobacco in the area were strongly biased against any crop of a similar nature. They claimed, as did a great number of tobacco growers in other districts, that they had received a very raw deal with smoking tobacco, subsequent to the tobacco boom during the time of the Scullin Government. Such factors as these are often decisive. It

had been established that a great deal of country was available in that locality which could produce the finest quality alkaloid-yielding material, given co-operation from producers. Other considerations such as drying space, irrigation, climatic conditions, soil fertility and local experience, could all be counted as being in favour, but this one problem proved insuperable.

As in Victoria, there was a number of other small plantings, usually isolated, and not great in extent.

In 1947/1948, contracting was again attempted in all these areas of Victoria and New South Wales, but was successful to a greater degree only in a few of them. In most instances, such as Orbost, Tumut, Tamworth and Shepparton, the area contracted remained much the same or may have declined a little, though the relation of area harvested to area contracted was very much better in all cases. This could be put down not only to the growers having a better knowledge of the work they were attempting, but also to their instructors knowing more of the detailed requirements of the crop in relation to its surroundings.

Just prior to the Spring of 1947, in which season the sowing of seed in covered beds takes place, a publicity campaign was again launched similar to, though perhaps broader in its coverage, than that of the previous year. A more extensive tour of the two States was carried out by Field Officers, as a little more time was available before sowing had to commence. Travelling with a representative of the Commonwealth Department of Commerce and Agriculture, they were able to hold meetings in a much greater number of places than formerly, but the response to these in many cases, and in spite of assistance by State Officers, was disappointing. An endeavour was made to interest growers in Northern New South Wales and Southern Queensland, but even in the tobacco areas of Texas Ashford and Goondiwindi, this met only with lukewarm interest.

Other States

A number of new centres was established, however, notably at Mildura in Victoria, and Wagga in New South Wales. Pioneering in the Forbes, Wellington and Mudgee localities of New South Wales and in the Western District of Victoria, might have borne fruit in future seasons had contracting been continued, and the same applies to tobacco-growing Northern New South Wales.

Commercial scale growing in South Australia and Western Australia was not developed during the available time, but would normally have followed.

Queensland

Rather late, but within the same season, an extensive tour of the coastal districts of Queensland was made in conjunction with the Department of Commerce and Agriculture to assess the prospects for establishment of rustica, both as regards the availability of suitable land and the attitude of Queensland farmers. In this State, again, the assistance obtained from the Department of Agriculture proved invaluable. It was found, for instance, that at Bowen, tomato growers had been experiencing losses, largely due to the heavy incidence of disease which was causing their crops to appear on the Sydney markets in very bad conditions. The prices then obtained would hardly recompense them for the high freight, even in the off season. It was thought that *Nicotiana rustica* could be grown there satisfactorily, in spite of its close relationship to tomatoes, and would prove sufficiently resistant, or little enough impaired in quality by diseases such as mosaic, to be acceptable as an alternative crop.

At Ayre, interest was being raised in the production of smoking tobacco, and a large area of fertile alluvium with very cheap irrigation was available. No appreciable drying space existed anywhere in this State, but it was hoped that temporary arrangements might be made using primitive bark huts, or scrub tim-

ber and malthoid or bitumenised paper, to provide sufficient shelter for the first crop, enabling a sound assessment of crop prospects to be made. However, there was a new difficulty here, too. Winter-cropped rustica might provide a host on which many pests of tobacco could carry over, to the detriment of summer-grown smoking leaf. Summer-grown rustica would compete with the establishment of the tobacco industry, particularly for labour and drying space.

At Mackay a large number of suitable types of men and farms, many with irrigation, were available, and a great deal of interest was shown in the new crop. Valuable assistance from the State Department's Officers in such areas as this simplified the provision of field service, and significantly improved the prospects for a high percentage harvest.

Proserpine, a hilly, dry-farming centre of cane-growing, may have supported some rustica production immediately following the "wet" but cane areas generally are not ideally suited to small cropping, owing to the attitude of cane-growers. Irrigation is practically a pre-requisite to rustica growing in Queensland, as elsewhere.

Although contracting had to cease before the possibilities of Queensland were more than superficially examined, it is our opinion that, given two or three seasons, vast areas of suitable country in Queensland could have been developed for the production of rustica. In many places more than one harvest could be obtained in a season, where irrigation is available. Although there is a great deal of good country, particularly on the deltas, the main disadvantage is that it is scattered, and the cost of visiting growers during initial seasons would be very great indeed, as the whole coastline from Townsville to Brisbane contains pockets which could be used. In addition, there is the fertile South-East, which might prove more difficult because of its greater number of profitable competitive crops.

Summary

In summary it may be said that *Nicotiana rustica* can be grown in many parts of Australia in such a way as to produce raw material of high alkaloid content suitable for nicotine sulphate production. Some picture has been given of the experience obtained in organising large-scale production of the crop—the major effect of local economy on growers' attitude to a new venture is perhaps the most significant feature for future guidance in work of this nature. As for the industry itself, it appears undeniably that *Nicotiana rustica* is the most desirable source of nicotine on account of its high yield of alkaloid per acre. The cost of such raw material is, however, very high compared with waste smoking tobacco. This is entirely due to the inevitable difference in cost between a prime product and a waste product. Yet lowering of the cost of production in the field and factory is always feasible with experience and the use of high grade raw materials, and a further improvement of the nicotine yield per acre by breeding and better cultivation methods. It is here that the potentiality lies for the modern production of competitive nicotine sulphate.

The question now arises whether the waste tobacco of the world can supply the world's needs of nicotine sulphate. The answer is probably negative, a view which will be endorsed by most smokers, who are firmly convinced that they know where waste tobacco is going. The contention is supported also by America's renewed interest *Nicotiana rustica* cultivation. This factor, together with steadily increasing overseas price for nicotine sulphate, makes it strongly advisable for Australia to hold an alert watching brief, and to be ready to consolidate and expand an industry of considerable importance to primary production. It is clear from experience in times of emergency that Australia should not depend on overseas supplies of an insecticide essential to her food production.

(*Received for publication May* 31, 1948)

POTATO IMPROVEMENT IN AUSTRALIA

By E. M. HUTTON

Seed certification schemes and the introduction of new varieties from overseas have done much to improve the potato crop in Australia. The aim of potato workers both here and overseas is to develop new varieties of good quality with field resistance to diseases and insect pests, and adapted to the various growing areas. It will take several decades to realise this aim, as there are still a number of agronomic, genetical, disease and insect problems awaiting solution. However, a considerable amount of proven fundamental knowledge is available so that potato agronomists could effect within a decade a marked improvement in varieties. Experience, notably in the United States of America, has shown that the centralised development of varieties is unlikely to produce types suitable to all areas and, consequently most improvement work is proceeding on a regional basis.

GENERAL AGRONOMIC REQUIREMENTS IN NEW VARIETIES

Australian potato growing problems and the characteristics needed in varieties for this country have been described by Bald.[3] In U.S.A. the requirements needed in new varieties have been summarised by Folsom and Stevenson.[10] More recently Stevenson[17] reviewed potato breeding literature. From these papers and information obtained by discussion with the potato agronomists of Victoria, Tasmania, New South Wales and Western Australia, the following notes on general agronomic requirements have been compiled.

Yield

A yield as good as or better than standard varieties with a high percentage of marketable tubers is desired. Relatively short stolons and tuber formation just below the crown of the plant make for ease of harvesting. Tubers should be easily detachable from the stolons when the crop is mature.

Tuber Characters

The demand is for smooth, shallow "eyed" tubers having a rounded or blocky shape and with a white, tough skin which stands transport and aids keeping quality. For export, Tasmania favours the Brownell type with a tough red skin. Modern types tend to have fewer "eyes", which are mainly at the rose end. This is a disadvantage when cutting setts, and it would be more desirable to have a blocky tuber with a relatively even distribution of "eyes".

The tuber "flesh" should be white before and after cooking, cohesive when boiled, mealy when baked and of good flavour. Factor or Up-to-Date is of poor quality compared with Carman. Potato agronomists obtain a good idea of quality by cutting transverse slices of tubers at harvesting. Those varieties giving opaque, fine and white slices are favoured to those which are translucent, coarse and badly coloured.

Keeping quality is recognised to be largely correlated with a long dormancy period. In Western Australia the local demand is for an early variety of relatively short dormancy. Where the grower requires varieties of this kind, some of the new hormone preparations which prevent sprouting may solve the problem of keeping the tubers in good condition for the consumer market.

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Growth Type and Resistance to Environmental Conditions

The general demand is for a vigorous leafy variety which tuberises early, and which has the ability to withstand periodic drought. A very desirable character is freedom from second growth of all kinds. The varieties Katahdin and Sebago are particularly resistant to second growth, a character which they transmit to hybrid progenies.

The ability to resist frost would be an advantage where early crops are grown, but the incorporation of this character in new varieties may prove difficult.

Resistance to Insect Pests

In Canada, Adams[1] has indicated the possibility of breeding for resistance to aphids, the vectors of most of the important virus diseases. This is a line of work worthy of further investigation, especially when the major problem is breeding for leaf roll resistance.

Resistance in the haulms and tubers to the larvae of the potato moth would be an advantage in areas where the latter part of the growing period tends to be hot and dry, as this insect multiplies rapidly, under such conditions.

Eelworm is present in certain Australian potato areas and by some it is considered to be on the increase. Snowflake has a worthwhile degree of field resistance to this nematode. Recent work has shown that a few species resistant to eelworm may be found in the Empire Potato Collection.

Resistance to Fungal and Bacterial Diseases

Early blight, late blight, rhizoctonia scab, common scab, fusarial and bacterial wilts, although not always consistent in their attacks, cause considerable losses in Australian potato crops but research on resistance to these diseases has not yet received much attention. Considerable progress has been made in late blight and common scab resistance by workers in other countries, and results to date with some of their material suggest that these resistances would be useful in our potato breeding programmes.

Varieties like Sebago have shown extreme susceptibility to bacterial wilt compared with other varieties like Carman. We have been fortunate in avoiding bacterial ring rot. In U.S.A. considerable progress has been made in developing types resistant to this devasting disease.

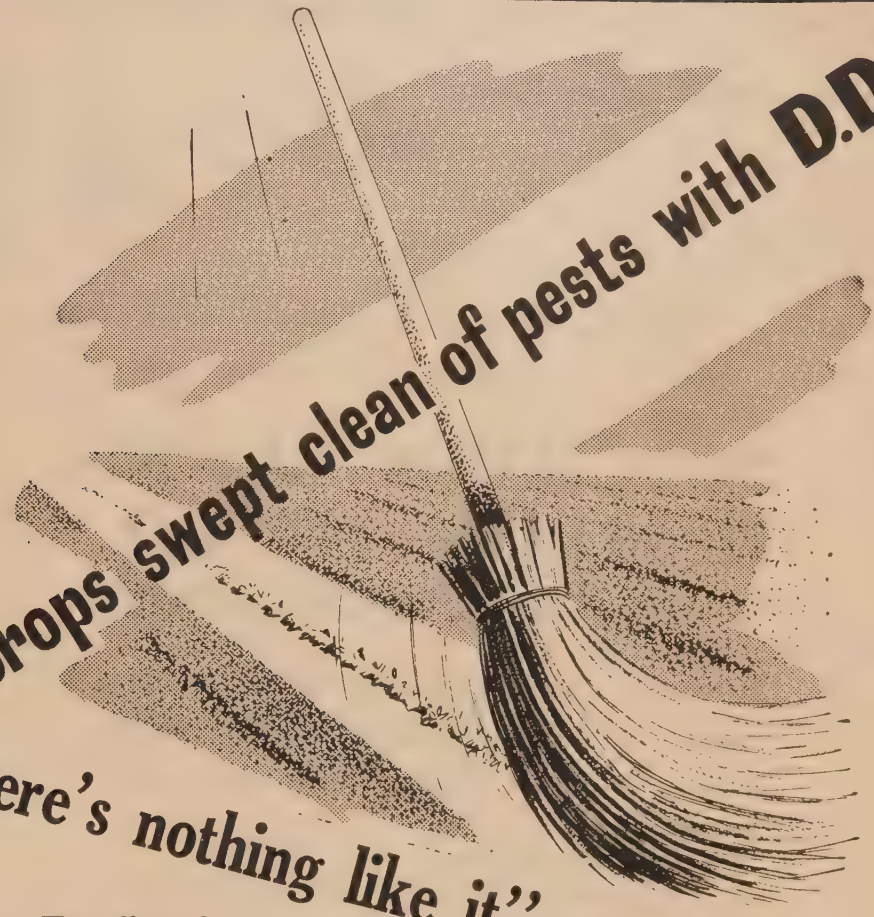
RESISTANCE TO VIRUS DISEASES

Field immunity to the aphis-borne viruses, leaf roll, A and Y, to the thrips transmitted spotted wilt and to virus X, which is spread by contact, is an important composite aim. Considerable losses would be eliminated if varieties possessing resistance to these viruses were available.

Virus X

Virus X or latent mosaic, has been until recently a constant feature of the important Australian varieties. Bald[2] has isolated virus-free clones of Factor, Bismark and Snowflake and has demonstrated the effect of virus X on yield. Well-organised certified seed schemes are necessary to make full use of these virus-free clones commercially.

All common Australian varieties are susceptible to virus X, but means are at the disposal of the breeder to develop resistant types with suitable field characters. Stevenson *et al*[16] found in two crosses each with the immune S41956 as one parent and the non-immune varieties Katahdin and Earlaine as the other parents, that 37 per cent. of the progenies were immune to virus X. Cadman[9] showed that the hypersensitive or field-immune reaction to virus X of varieties like Epicure was inherited as a dominant character. Black and Haigh[8], speaking of English and Scottish conditions, state that it would now be practicable to prohibit the introduction into commerce of all varieties susceptible to virus X in view of the means now at the disposal of the breeder, and the relative ease with



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which X resistance can be incorporated into new seedlings.

Virus Y

Virus Y or rugose mosaic has not been a constant feature in varieties like virus X, but it has been troublesome in areas as at Ballarat, Victoria. Carman, Factor, Bismark, Brownell and Delaware are quite susceptible to virus Y, but Bald and Pugsley[4] showed the variety Snowflake to have high resistance to virus Y in the field due to its severe necrotic reaction to this virus. Bawden and Kassanis[6] have shown the variety Katahdin to be almost field immune to virus Y under English conditions. It has been shown (Hutton[13]) that by inter-crossing varieties like Katahdin and Snowflake that the necrotic reaction can be developed to the stage of hypersensitivity. The position is complicated by the occurrence of strains of Y (Bawden and Kassanis[7]) and the effect of stage of growth on resistance, but it is now practicable for potato agronomists to develop high-yielding varieties which are field resistant to this disease.

Virus A

Virus A or mild mosaic has almost been eliminated from certified stocks of Australian varieties. However, Carman, Brownell, Bismark and Delaware are susceptible to it. Factor, Snowflake, Katahdin and Sebago are field immune to it, and this factor is transmitted to a high percentage of the progeny of crosses involving them. The only difficulty is the development of a suitable testing procedure for the A resistance of hybrids. Virus A has proved a difficult virus to handle, as it is not easily inoculable by hand and the results from graft and aphis transmissions are often of a negative nature.

Leaf Roll

The development of leaf roll resistance has proved difficult, due to the slowness and unreliability of testing methods and to the fact that almost complete masking of symptoms can occur under good growing conditions in tolerant varieties and hybrids. In addition, work has tended to show that the leaf roll resistance of Skerry Champion and other European varieties is not clear cut and is dependent on a number of genetic factors easily dispersed in outcrossing. Recent work by Bald, Norris and Helson[5] has shown the resistance of Bismark to depend on intolerance to leaf roll.

Among common varieties Factor, Sebago, Katahdin and Brownell symptoms of leaf roll may be masked under good conditions, and even under poor growing conditions it is not always certain that the rolling observed in these varieties is due to leaf roll. Masking of leaf roll does not occur to the same extent in Carman, so that leaf roll is not a problem in Victorian certified crops of this variety. Snowflake, which is grown to some extent in Victoria, shows unmistakeable symptoms when infected with leaf roll, irrespective of growing conditions. Varieties like this are easily rogued for leaf roll, so that it is easy to keep certified crops free of this virus. In addition it appears that varieties which show mild symptoms when infected with leaf roll are less resistant than varieties which show well-defined symptoms. It has been shown that in hybrid potato progenies, the seedlings can be grouped into tolerant, medium or severe reactors to leaf roll. This is illustrated in *Figure 1* by three seedlings from the cross Snowflake x Katahdin.

In development of new varieties, the leaf roll problem could be largely overcome if seedlings similar to the type showing severe reaction to this virus in *Figure 1* were released. Seedlings like this would not show masking under good conditions, whereas tolerant types as in *Figure 1* would be masked under most conditions, and those with a medium reaction would be masked under good conditions. The tendency overseas has been to release seedlings with a tolerant re-

Figure 1.
Three potato seedlings showing medium, tolerant and severe reactions to leaf roll.

action to leaf roll, and this, together with the fact that a number of our important varieties are tolerant under good conditions, has made the elimination of leaf roll, even from certified stocks, a difficult problem. More recently Wilson[18] has demonstrated how the technique developed by Sheffield[15] for the diagnosis of leaf roll by the occurrence of phloem necrosis can be improved. This technique is a valuable aid to the potato agronomist for the detection of tolerant reactors to leaf roll.

Spotted Wilt

In certain areas of recent years spotted wilt has been a sporadic and devasting disease of potatoes. Some of our common varieties like Carman, Factor and Bismark are very susceptible, whereas Katahdin and Snowflake are highly resistant. Recent work (Hutton[14]) has indicated that most potato progenies contain relatively high percentages of resistant seedlings.

Immediate Objectives Possible of Achievement

Although the ideal potato may be several decades away it is possible within a decade with a well-planned programme to incorporate the following characters into new varieties—high yielding ability with good tuber characters and good cooking quality, ability to resist periodic drought and the development of second growth, field immunity to viruses X and A and near field immunity to virus Y and spotted wilt, an unmistakeable and hence resistant reaction to leaf roll, and high resistance to late blight and common scab. Hybrids of high yielding ability with these virus resistant factors have already been developed to demonstrate the virus resistance aspects of the problem. It only remains for potato agronomists to place this work on a regional basis to ensure success.

At present the breeder is fortunate in that all the desirable characters mentioned as immediate objectives are available in current varieties. It may well be that to gain all the characters needed in the ideal potato, recourse will have to be made to the Empire Potato Collection. At Cambridge University a number of workers (Hawkes[11]) are investigating the disease resistance and fundamental problems associated with the use of wild potato species in potato hybridisation. Up to the present the factors for immunity to late blight present in certain commercial varieties have been derived from *Solanum demissum*.

GENERAL BREEDING PROCEDURES.

Crossing Techniques

Best crossing results are obtained in highland areas which have cool nights and relatively mild days in late spring and early summer. Each State has an area where successful pollinations can be carried out. The most satisfactory results are obtained by early planting and the encouragement of vigorous growth, if necessary by suitable enclosures, watering and nitrogenous manuring, so that the maximum flowering is obtained during the cooler conditions of late spring and early summer. A pollination tool like a miniature scoop made by cutting out a cavity behind a point in the thick part of a dissecting needle facilitates crossing. This instrument easily "scoops" and collects the pollen from the anthers and can be sterilised with alcohol between pollinations. The covering of pollinated flowers with cheese cloth bags is preferable to paper bags, which tend to cause excessive flower abscission.

Seed Extraction

Seed "balls" are gathered when fully formed and the seed is squeezed out under water just before the "balls" become soft and mushy. The elimination of the slimy material from around the seed is facilitated by adding a few cc. of hydrochloric acid (Hutton[12]) to the water, the amount added depending on the amount of water and seed. With small quantities in the laboratory about 20 cc. of acid to 200 cc. of water containing seed is a good proportion, the mixture being stirred and left about an hour before washing.

Germination of Freshly Harvested Seed

Freshly harvested seed is difficult to germinate. If it is required to germinate the seed soon after harvesting, the following has been found to be a good procedure. Shake and soak the seed in concentrated bleaching powder solution for eight hours, wash it on to a filter paper which can then be rolled up in a test tube with a cotton wool plug and place the test tubes in a refrigerator for 14 days just above freezing point. In this way it has been possible to squeeze seed from a seed "ball" and have it germinating satisfactorily in three to four weeks from extraction.

Breeding Procedure

By selecting within progenies having one or more of the desired characters and inter-crossing the most promising seedlings, success can be obtained quickly. The potato is very heterozygous and indiscriminate crossings dilute the desirable characters so much that it makes it extremely difficult to effect the desired combinations. The following is an example of the type of procedure which can be followed. A cross was made between S41956 and a Snowflake x Katahdin seedling previously selected for sensitivity to virus Y. The progeny of 300 seedlings was then grown in the field and the 36 best agronomic types were selected. These were then tested for immunity to X and half were eliminated. Those remaining were tested for their reaction to virus Y and the nine best necrotic reactors to this virus were selected for inter-crossing. From these nine, four successful inter-crosses were made and the progenies consisting of 500 seedlings were grown in the field for agronomic selection. Some 100 promising types were selected agronomically, and due to the concentration of genes conditioning virus reaction, 60 of these had promising reactions to both viruses X and Y when tested. Further work demonstrated that 20 of these had a severe reaction to leaf roll. Of these 20, 15 had immunity to virus A. Subsequent field work has demonstrated that six of these 15 hybrids were promising agronomically. It can be seen from this, that with sufficient concentration on lines promising the desirable characters, the re-

quired combination of disease resistance and agronomic quality can be obtained.

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(*Received for publication 26th May*, 1948.)

TECHNICAL NOTES

THE USE OF THE PHLOROGLUCINOL TEST FOR DIAGNOSIS OF LEAF ROLL IN POTATOES

Leaf roll virus has for long presented a problem in seed potatoes in Tasmania as the main variety, Brownell, and the variety third in importance, Up-to-Date, are particularly susceptible. Good control has usually been maintained by virtue of seed certification, but on occasions the incidence in certified seed crops has exceeded what might be regarded a reasonable level.

The limiting factor in control has been the difficulty of early and certain identification of the disease. In the past reliance has, of necessity, been placed on field diagnosis but this has proved unreliable on account of the degree of masking which occurs under conditions favouring vigorous growth. In good seasons and where soil fertility is high, it has been found that, even to an experienced observer, infected plants of Up-to-Date and, to a lesser extent, Brownell may be indistinguishable from healthy ones.

Phloroglucinol Test

With the idea of introducing a rapid and reliable routine test which would serve as a check on field observations, the technique described by Sheffield[1] for the use of phloem necrosis in leaf roll diagnosis was tried. This involves sectioning the stems near ground level, treating the sections with 1% alcoholic phloroglucinol solution and then with 50% hydrochloric acid when leaf roll infected plants are identified by yellowish-red staining of necrotic areas in the primary phloem region. Necrosis in the primary phloem of the bicollateral bundles is considered by Sheffield to be a constant and specific feature of leaf roll infection.

Early attempts in the use of the test gave negative results. Although stems from undoubted leaf roll infected plants were used, it was not possible to detect the presence of stain in phloem tissue which appeared necrotic. Occasionally traces of colour were observed but these were so faint and transient as to be unconvincing, and certainly of no use for diagnosis.

To determine whether insufficient release of pentose through inadequate

hydrolysis was the reason for failure, stronger acid was tried in the staining procedure. After the phloroglucinol solution was drained off, concentrated HCl (10 N.), instead of the 50% specified by Sheffield, was added and the slide heated over a flame for a few seconds. This modification gave immediate success. Necrotic phloem turned pink to purplish-red, similar to and of the same order of colour intensity as the xylem tissue, and consequently stood out quite clearly.

It was subsequently found that heating of the slide was unnecessary, cold concentrated HCl giving satisfactory results. This is now used exclusively. Acids of various dilutions have been tried for comparison but have been found to give less distinct staining or none at all.

The use of concentrated acid instead of dilute does not appear to be open to any objection on theoretical grounds. It seems that effectiveness in liberating pentose from necrotic phloem need be the only consideration taken into account in the choice of acid strength. Moreover, 300 or more stem examinations in which concentrated acid has been used, have given no reason to believe that results contrary to those recorded by Sheffield are being obtained. Instead, accumulation of evidence has served to confirm most claims made for the original test.

Observations which are in agreement with those made by Sheffield are as follows:—

(1) Stained areas of the type characteristic of leaf roll infection have not been observed other than in the primary phloem region. Occasionally healthy cells stained red or cells in which the corners only have taken up the stain, are seen, but it is agreed that these are not liable to be confused with necrotic phloem.

(2) There has been no reason to doubt that phloem necrosis is a constant and specific character of leaf roll infected plants. Evidence on this point, however, is based largely on the observed correlation between field diagnosis and presence of phloem necrosis. As there is usually a fair element of uncertainty associated with field diagnosis, evidence depending on this cannot be regarded as conclusive. However, in a few cases steps were taken to check independently, by growing on, the leaf roll status of plants tested. Of those so checked, all having leaf roll showed necrosis and those which proved healthy were free.

(3) Leaf roll occurring as a varietal character (in a number of new hybrids) and rolling due to Rhizoctonia attack were not accompanied by necrosis.

(4) Necrosis may occur in the internal or external phloem or in both together. However, it is usually confined to the external phloem.

No attempt was made to confirm the stage in the growth of the plant at which phloem necrosis could first be detected. All tests were conducted on well-grown plants near to or beyond flowering stage.

Relationship Between External Symptoms and Phloem Necrosis

Sheffield considers that in any one variety the amount of necrosis is correlated with the severity of external symptoms. This has been found to be only generally true. Cases are often encountered in which severity of external symptoms bears little or no relation to the amount of necrosis found. In Table I there are classified, according to severity of symptoms, forty-two plants of vari-

TABLE I.

Relationship between Phloem Necrosis and Field Appearance.

Severity of Field Symptoms	Extent of Necrosis		
	Severe	Moderate	Slight
Severe	7	5	0
Moderate	8	3	0
Slight	5	8	6

Figures indicate number of plants.

eties Brownell and Up-to-Date which gave a positive phloroglucinol reaction and for which descriptions of the field appearance were recorded at the time stem specimens were taken.

It is apparent that for this group of plants there is not a close correlation between severity of external and internal symptoms. For instance, of twenty plants with severe necrosis, five showed only slight external symptoms and would have been regarded as doubtful on field diagnosis alone.

That some plants considered doubtful in the field should show severe necrosis whereas others with pronounced leaf roll and dwarfing should show only a moderate amount of necrosis is evidence that the two conditions are at least not related in the manner of cause and effect.

Use of the Phloroglucinol Test in Certification

The phloroglucinol test is now being used for the routine testing of plants retained for use as foundation stock in the Tasmanian seed potato certification scheme. By this means it is anticipated that foundation areas at least can be maintained free of leaf roll.

In later stages of multiplication the test is used as an aid in diagnosis. The availability of a means of deciding in doubtful cases between true leaf roll and leaf roll appearance due to other causes as well as indicating the extent of masking in certified seed crops, is proving of considerable value in rogueing and inspectional work.

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(*Received for publication 26th May,* 1948.)

THE NATURE OF FUSARIUM WILT RESISTANCE IN THE TOMATO VARIETY PAN AMERICA

The tomato variety Pan America was bred in U.S.A. by Porte and Walker[4] for resistance to *Fusarium bulbigenum* var. *lycopersici.* Hutton, Mills and Giles[2] have shown that Pan America and Pan America hybrids have field immunity under Australian conditions. Heinz and Andrus[1] consider that this resistance is due to the localization of the organism in the roots of the Pan America plant. Snyder, Baker and Hansen[5], however, assert that the resistance is not localized in the root system and that the field resistance of Pan America functions in the living cells of the root through which the fungus must pass to become a vascular pathogen.

Observations on Pan America plants inoculated by the method of Mills and Hutton[3] show that some vascular browning can occur in the roots of plants which do not wilt. Re-isolation of the pathogen can be effected from apparently healthy roots and from roots showing vascular browning. Isolations from the roots of a Pan America hybrid which was showing field immunity again yielded the pathogenic organism. Vascular browning does not extend into the above ground portion of these plants and attempted re-isolations from the stems were unsuccessful.

Pathogenicity tests on these isolates, *Table* 1, show them to be of the same order of pathogenicity as the strain used for glasshouse inoculations. This strain

TABLE 1.

Pathogenicity Test on Re-isolates of F. bulbigenum var. lycopersici.

Isolate.	Bonny Best. No. of Plants.			Pan America. No. of Plants.		
	Failed to Wilt.	Wilted.	Total	Failed to Wilt.	Wilted.	Total
Normal Testing Strain.	6	36	42	65	0	65
Re-isolate from Pan America Roots (Glasshouse).	5	30	35	47	1	48
Re-isolate from Pan America Hybrid Roots (Field).	0	18	18	36	0	36

was the highly pathogenic strain selected by Mills and Hutton[3] in their search for resistance to Fusarium Wilt.

Thus although the normal pathogenic strain of Fusarium can gain entry to the roots of the field immune tomato plant, its growth and ability to wilt the plant is checked. It would appear that a state of equilibrium is reached between the plant and the pathogen. Attempts were made to upset this equilibrium by affecting the plant growth.

Thatcher[6] has reported an increased susceptibility in cereals resistant to rust, when the plants were exposed to an atmosphere of chloroform after inoculation. An attempt to upset the plant-pathogen equilibrium in Pan America was made by exposing plants to an atmosphere of chloroform, 0.02 cc. per litre of enclosed air, 28 days after inoculation. Examination of the plants 16 days later revealed no Fusarium Wilt symptoms. No re-isolation of the pathogen could be made from the above ground portion of the plant.

A further attempt was made by subjecting previously inoculated plants to the virus diseases Tomato Spotted Wilt and Potato Virus X. Virus inoculations

TABLE 2.

Results of Fusarium Inoculation on Pan America plants also infected with Tomato Spotted Wilt and Potato Virus X.

Inoculation.	Reaction to Fusarium Wilt. No. of Plants.		Total.
	Resistant.	Susceptible.	
Fusarium	30	2	32
„ + Tomato Spotted Wilt	30	16	46
„ + Potato Virus X	38	3	41
Uninoculated	22	0	22
Tomato Spotted Wilt	24	0	24
Potato Virus X	27	0	27

were carried out 13 days after fusarium inoculation. Examination of the plants was made 15 days later. The results of these tests are shown in *Table* 2.

The rating for resistance and susceptibility was made primarily on whether the vascular browning extended above ground level. Hutton, Mills and Giles[2] have shown that this method is indicative of plant resistance or susceptibility.

Of the 32 Fusarium inoculated plants, 19 plants showed no vascular browning, 11 plants had vascular browning of the root area, in the two plants classed as susceptible the vascular browning extended only to the cotyledons and 28 days after inoculation these plants showed no external wilt symptoms.

Of the Fusarium-Spotted Wilt inoculated group, all of the plants exhibited some vascular browning, 30 plants had vascular browning of the root area, the remaining 16 susceptible plants all had vascular browning extending into the stems.

Check plants uninoculated or inoculated only with Tomato Spotted Wilt or Potato Virus X showed no vascular browning.

Re-isolation of the pathogen were made to confirm the ratings on vascular browning (*Table* 3).

It would appear that Pan America is resistant because it is able to check the growth of the pathogen, and establish a state of equilibrium, rather than to prevent its entry or localize it in the root system.

The addition of a strong virus pathogen, Tomato Spotted Wilt is sufficient to upset this equilibrium and reduce plant resistance to the extent that the fungus can grow into the above ground portion of the plant. Where a less virulent pathogen, Potato Virus X is used this effect is not so marked.

TABLE 3.

Re-isolation of F. Bulbigenum var. Lycopersici from Pan America Plants infected with Tomato Spotted Wilt and Potato Virus X.

Inoculation.	Plants Rated as	Position of Vascular Browning.	Area where Re-Isolation Successful.
Fusarium	Resistant	Absent or Root Area.	Root Area.
Fusarium + Tomato Spotted Wilt	„	Root Area.	„ „
	Susceptible	Root and Stem Area.	Root and Stem Area.
Fusarium + Potato Virus X	Resistant	Absent or Root Area.	Root Area.
	Susceptible	Root and Stem Area.	Root and Stem Area.

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(*Received for publication 26th May*, 1948.)

GUIGNARDIA CITRICARPA N.Sp. AND ITS RELATIONSHIP TO THE BLACK SPOT DISEASE OF CITRUS IN COASTAL ORCHARDS OF NEW SOUTH WALES

It was considered formerly, that the principal source of latent infections on young, susceptible Valencia fruits, was provided by pycnidiospores of *Phoma citricarpa* McAlp., that had developed in lesions on mature fruit hanging in the same or nearby Valencia trees. However, the lack of any demonstrable control of the disease, when such affected fruit was harvested prior to the setting of the susceptible new season's crop in mid-October, in an orchard under isolated conditions, suggested the possibility of an alternate source of inoculum other than the pycnidiospores.

Sources of Inoculum

Pycnidia, spermogonia, pycnidio sclerotia and an undescribed ascigerous stage developing inside the latter structure, were observed to have been produced and were occurring to a very large extent over the entire surfaces of dead citrus leaves in most central coast orchards. The relationship of these structures of *Phoma citricarpa* has been established both by cultural and infection studies. On the grounds of its conformity with the type genus Guignardia, this sexual stage has been named *Guignardia citricarpa.* Apart from its occurrence as latent infections on all varieties of citrus, *G. citricarpa* has been shown to be present in the latent condition within the leaves of a number of native bush shrubs and cultivated plants, belonging to nine different natural families. These native alternate host plants are, the Waratah, *Telopea speciosissima* R.Br., the wild sarsaparilla, *Smilax australis* R.Br., the Turpentine tree, *Syncarpia laurifolia* Ten., the Christmas Bush, *Ceratopetalum gummiferum* Sm., and the red flowering bottlebrush, *Callistemon lanceolatus* D.C. As well, latent infections have been determined on the following cultivated plants and shrubs, camellia, magnolia Holly, the bush orchid, the youngberry and the almond tree. In the instance of all these plants, the infections are not apparent on the green living leaves. However, following their death, aseptic precautions being observed, the various fructifications of *G. citricarpa* appear over the entire surface of the leaves.

Factors Influencing Development of Ascocarps

The development of *G. citricarpa* on the surface of sterilised dying leaves of various citrus varieties has been demonstrated to originate from latent infections that were present in the green leaves on the tree, and not as a true saprophytic growth of this fungus, originating from spores lodging on the leaves after their death. This production of pycnidia spermogonia and perithecia of *G. citricarpa* on dead citrus leaves was all the more remarkable, as leaf lesions on the living orange foliage are particularly rare in orange trees under central coastal conditions. Leaf lesions are occasionally seen, however, on lemon trees.

Details of this study and the description of the ascigerous fungus will be published elsewhere shortly, along with other aspects of the Black Spot problem, as it affects the production of Valencia fruit in coastal citrus orchards.

A number of factors were found to influence the successful production of the causal fungus on dead and dying citrus

leaves. Wilting of the green citrus leaves by exposure to the sun for periods varying from six to twelve hours, after their removal from the tree, greatly increased the chances of developing the latent fungus. Alternate wetting and drying of these leaves daily after wilting also favourably influenced the development of *G. citricarpa*. Generally, six days after their removal from the tree a profuse development of spermogonia and pycnidio-sclerotia appeared on the leaves. Temperature at this stage influenced this development to some extent, and an incubation range of 25 deg.-30 deg. C. has been found desirable. The maturity of citrus leaves greatly influenced the result obtained by "wilting" after removal from the tree. Young leaves, of only a few months maturity required much longer periods of exposure to the sun to achieve the development of the various fungal fructifications.

Latent infections of *G. citricarpa* have been demonstrated to survive eighteen days in wilted air-dried citrus leaves, and then produce fructifications subsequently when such leaves were moistened. This would indicate that even under very hot arid environmental conditions where it might be expected that fallen old leaves would desiccate too rapidly, resulting in the death of the latent mycelium, there would be a very high probability that latent infections in fallen young leaves would survive even in the absence of dews for several nights. In this way production of ascospore inoculum would be assured.

Maturation of ascocarps is generally achieved after a period of three to four months after the leaves have fallen from the tree. Ascospores are discharged from the perithecium, and have been shown to be air borne. This constitutes the principal source of infection of the disease; and some indication of the intensity of this form of inoculum can be gauged from the finding that mature perithecia of the causal fungus occur in dead citrus leaves throughout the entire year.

It has been shown that evening dews are extremely important in providing the correct conditions for ascocarp maturation. The alternate wetting and drying of the dead leaves which is provided by nightly dews followed by fine days, ensures the maturation of ascospores. It has been demonstrated too, that heavy dews are sufficient to secure ascospore

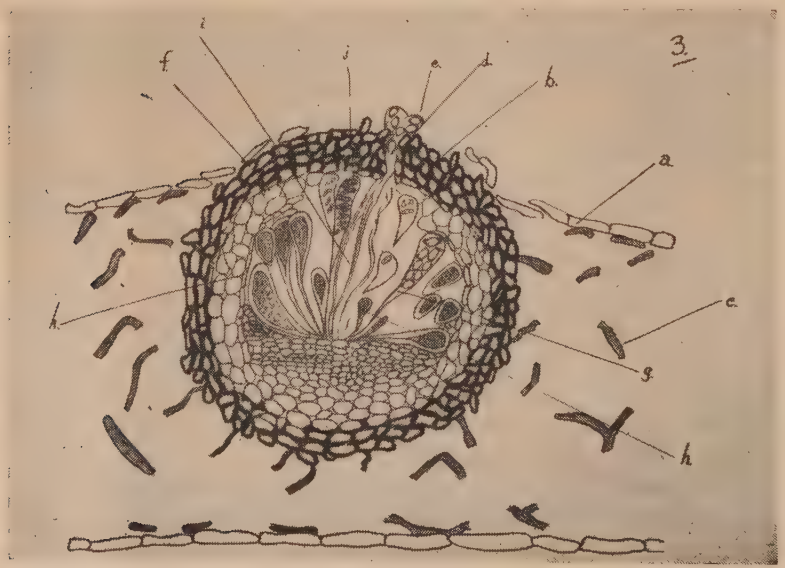

Figure 1.
An oblique section through a mature perithecium section cut through the ostiole. (a) Epidermal cells of leaf. (b) Carbonaceous outer pseudoparenchymatous wall of perithecium derived from the pycnidio-sclerotium. (c) Mycelial strands completely replaced the host mesophyll tissue. (d) Perithecial ostiole formed by mechanical rupture and histolysis (?) of the outer pseudoparenchyma. (e) Ripe asci (two) protruding through the ostiole. Ascospores are aggregated at the tips of the asci. (f) Large cells remaining of the original pseudoparenchymatous tissue of the pycnidio-sclerotium. (g) Ascus with mature ascospores. The base of the ascus is about to elongate and bear the structure up to the ostiolar opening. (h) Immature asci still forming. (i) Elongated portion of ascus which is protruding through the ostiole. (j) Remains of ascus after the ejection of the ascospores.

discharge from mature perithecia, although periods of rain at this stage are probably more important in securing a more intense discharge.

The Bordeaux Mixture spray deposits on citrus foliage, in no way interferes with the production of the various fructifications of *G. citricarpa* from latent mycelium on these leaves, as they die. Nor has the continual use of Bordeaux Mixture in many commercial citrus orchards for periods up to ten years, at strengths which are giving satisfactory control of the disease on the fruit, resulted in a reduction of the ascospore inoculum. Apparently Bordeaux Mixture sprays applied at a time calculated to afford maximum protection to the young fruits, have been useless in preventing latent infections becoming established in the leaves. Subsequently a number of foliage protection sprays of Bordeaux Mixture were made during the month of September, but these proved unsuccessful in preventing infection of the leaves.

Latent Infections in Leaves of Nursery Trees

Although older citrus trees have been found to provide a more reliable source of inoculum from their dead leaves, latent infections have been demonstrated in the apparently healthy green leaves of citrus yearling trees in coastal nurseries, and the causal fungus has been developed on the dead leaves from such trees. Yearling trees infected in this way provide a continual source of potential inoculum, year after year, to be introduced into the inland irrigation settlements which, up to the present, are apparently free of this disease. That the disease can, and from time to time has been established in this way, is indicated by the writer developing *G. citricarpa* from its latent form in one green Valencia orange-leaf out of ninety-one sent from Leeton on the Murrumbidgee Irrigation area in 1941.

An interesting feature of this disease is the manner in which infections of the causal fungus can become established in the young fruit and leaves, of the various citrus varieties, and yet remain latent for many months. With young trees, the mature fruit lesions never develop despite the fact that their infection has been demonstrated. As these trees age, the disease appears in its recognisable form on the mature fruit. This is about the eighth to tenth year, under central coastal conditions. However, Valencia trees up to twenty-five years old are also present in the same district, whose fruit at maturity is not affected by the disease. Latent infections, however, have been demonstrated in the rind of these fruit. Such findings indicate that the failure to observe the typical lesions of this disease on the fruit at maturity in an area considered to be free from the disease, does not mean necessarily, that the causal fungus is absent. The life cycle could be completed, year after year, without anyone becoming aware that the organism was present. Under such circumstances, the demonstration of latent infections within the green citrus leaves, and the presence and identification of the ascigerous fungus, *G citricarpa* on the dead citrus leaves in the orchard, are necessary in order to prove the presence of the causal organism. The potential threat, of the development of macroscopic lesions on the mature fruit in some future season, would then become obvious.

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(Received for publication 6th May, 1948.)

DIGESTS

INTERNATIONAL ASPECTS OF AGRICULTURE

By F. W. BULCOCK

The history of the F.A.O. (Food and Agriculture Organization) commenced in 1942 with President Roosevelt's moves for adequate food supply, the Atlantic Charter and the subsequent Hot Springs' Conference. The Hot Springs' Conference enunciated an agricultural philosophy. As a result of this conference the F.A.O. was born at Quebec when a charter obligating good agricultural practice and adequate food supply was drawn up.

At the subsequent Copenhagen conference the ideals of the Quebec conference began to be transformed into practice.

Three important steps were taken:—

(1) The recognition of the fact that the farmer must get an adequate return for his produce.
(2) The recognition of the necessity for adequate nutritional standards.
(3) The appointment of a World Food Board Preparatory Commission which consisted of representatives of 18 nations under the leadership of Lord Bruce.

At Geneva 54 nations adopted the World Food Board Preparatory Report and the World Food Council with 18 member nations was set up.

Present World Food Position

With the population increasing at the rate of 20 million per year and most countries below prewar production levels, there is great danger of starvation and want if adverse seasonal conditions affect one of the major food producing countries.

The position in Europe and the Eastern countries is accentuated by the lack of consumer goods; the peasants not being able to buy consumer goods retain a greater proportion of their produce than normally.

The livestock position in Europe is most acute. The present numbers are lower than at any other time over the last 50 years and recovery is limited by the shortage of grains which are being used for human consumption.

The world livestock position is falling off also. In Brazil the decrease in stock numbers is due to the socialistic policy with higher wages. The decrease in the Argentine is due to bad agricultural practices. In U.S.A. and Australia the decrease is due to the limiting of bread grains being fed to stock as well as the ravages of soil erosion.

The Solution

The solution to the world food shortage can only be overcome by:—

(1) More intensive development of existing lands.
(2) Greater application of scientific agriculture.
(3) Development of new areas.

The problem of opening new areas is essentially one of the Southern Hemisphere, South Africa, Latin America and Australia. The east is looking with hungry eyes at Australia's vast undeveloped areas, thus Australia must make a material contribution to the increased standard of living and nutrition in the east, if we are to keep our shores free from invaders.

At present the whole 58 members of F.A.O. are reporting on their present and future agriculture. These reports will be available in September of this year, and from them it will be possible to get a stable picture of world agriculture and this, in turn, should result in the development of a stable system of world agriculture.

(From an address delivered to the A.C.T. Branch on May 13, 1948. Mr. F. W. Bulcock is Director-General of Agriculture.)

How green is your valley?

Australia's soils and climatic conditions are suitable for the growth of a wide range of fruits, vines, vegetables, cereals and pastures. Scientific breeding of plants and animals has developed special crop varieties and strains of stock to suit local environmental conditions. Chemistry, too, assists in the production of agriculture's greater yields and finer quality. The Chemical Industry manufactures plant food in the forms of fertilisers to promote healthy growth, insecticides for pest control, fungicides to maintain healthy crops, hormones to stimulate growth, weedkillers to destroy harmful vegetation, veterinary medicines for stock, and sterilisers for control of microbes in the dairy and elsewhere. The outstanding recent developments of chemical research, "Gammexane", D.D.T. and Phenothiazine, are all manufactured by Imperial Chemical Industries in the interests of primary production.

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REVIEWS

COMMERCIAL POLICY IN RELATION TO AGRICULTURE

The Tenth Report of the Rural Reconstruction Commission

This Report fully maintains the standard set by the Commission in its previous Reports for wide observation of fact and exhaustive analysis of the many complex problems which beset the Agricultural Industries.

The report is devoted to a study of commercial policy in relation to Australian agriculture. In the words of the Commission "it deals with the complex factors of commercial policy in relation to agriculture. It reviews Australia's external economic policy as it affects the primary industries; discusses the present position and postwar problems; and makes recommendation regarding future policy in that field. It also discusses problems associated with domestic economic policy affecting the primary industries, including price guarantees and the like, and it makes recommendations in regard to these matters. . . . It also proposes a comprehensive change in the organisation of the farming industries so as to confer greater rights and impose greater responsibilities on those industries in the development of national policy affecting them."

Easy Reference

The method of presentation follows that adopted in the previous reports, the paragraphs being numbered consecutively throughout the ten reports which should facilitate reference. The practice of italics and underlining of what the Commission evidently considers to be the salient points in its theme has the advantage that he who runs may read and, it might be remarked in parenthesis, simplifies the work of the reviewer. The procedure usually followed by the Commission in discussing any problem is to give a presentation of the facts as they can be shown to exist, prefaced where appropriate by some historical review of the events that led up to such position and then to enunciate a set of principles within which action may be considered and by exhaustive analysis discuss the various possibilities until one course of action is seen to emerge as preferable to the others. This gives a very lucid and orderly development and it has an air of persuasive logic that is specious only in so far as the premises from which the Commission argues may be incomplete or open to challenge.

The method of analysis and presentation at times gives some appearance of over elaboration on points that to many will seem self evident. However, it is not clear exactly what reader or class of reader the report is designed to serve and it is probably wise for the Commission to leave no blanks in its chain of argument although it seems to the reviewer that if differences of viewpoint from those expressed by the Commission were held it would be with the Commission's premises rather than with the logical steps by which it advances from its premises to recommendations.

To some extent the Commission disarms any critical approach as to the fundamental bases of its approach to the subject of external commercial policy by its statement on page 66. "Whether reduction in tariffs could best be brought about by multilateral action or by bilateral agreements is a question which need not concern the Commission. What does

concern it is the necessity for an increased world trade in agricultural products in relation to Australian agricultural development."

Independent Approach

Though at first glance the Commission's position with respect to Australian postwar trade policy might seem one of compromise and not very bold when looked at with memories of the roseate glow diffused by hopes and aspirations of the days of the Atlantic Charter, yet examined more closely, the report takes on a more positive aspect. It plainly states that some concessions with respect to empire preference are necessary or desirable in return for reciprocal concessions from "foreign" countries and it examines in some detail each of the major primary export commodities with a view to evaluating its probable prospects in postwar trade and the extent to which preference reductions are feasible. That the Commission's attitude in this matter shows at least some independence of mind and a willingness to "think through" the problems involved will be the more clear when one remembers the Jeremiads in the press from Commercial interests and the wails that Australia had been "sold down the river" by inexperienced planners and bureaucrats at the recent Geneva Trade Conference.

The Commission, while deprecating any return to "laissez faire" in marketing that will expose producers to disastrous fluctuations in price yet dissociates itself from attempts to rigidly control production or the activities of growers. It is not altogether easy to have one without the other and the Commission, perhaps wisely adjudging discretion the better part of valour, makes no attempt to blueprint the possibilities other than to indicate buffer stocks as a possibly useful safeguard. It seems to the writer that the degree of control that is advisable or feasible with respect to any commodity is largely bound up with the internal structure and organisation of each particular industry and in so far as a reconciliation of the conflicting aims is possible, it might perhaps be most profitably attempted by an analysis of the previously existing and wartime marketing schemes.

Summing Up

The Commission's approach to the problems discussed in the Report may, it seems to me, be broadly summed up as follows:—

1. It desires no policies that will tend to have a restrictive effect either on world trade as a whole or on the production of Australia's major export commodities.
   It analyses in detail, on the basis of past trade statistics and careful consideration of possibilities in the various overseas markets taking into consideration the existing framework of Empire preference and also such influences on world trade as may be expected to emerge from the Atlantic Charter, the Hot Springs' Conference and other postwar developments, the prospects for each of our major export commodities. As a result of the analysis it makes certain recommendations for collaboration with other empire countries with the object of formulating common policy directed towards the mitigation of economic nationalism and also recommendations that the Government should give consideration to the possibilities of concluding suitable international commodity agreements for Australia's principal export commodities. It points out, however, that rigid control of the production of a number of commodities is not recommended and that international agreements cannot be regarded as a satisfactory substitute for buoyant world trade.
2. On the side of domestic policy the Commission emphasises the claim

of the farmer to a reasonable income and to participation in the domestic and social amenities available to the community generally. It claims that overall or unlimited price guarantees are not necessary to achieve this end and that a reasonable level and stability can be assured to producers without the rigidity and virtual subsidisation of inefficient production that has often characterised such schemes in the past.

3. The Commission recommends the setting up of an independent tribunal or authority to consider and report to the Government on the claims of the farming industries for assistance, the prices to be sought in international or domestic commodity arrangements and the appropriate levels of home consumption prices for export commodities where applicable.

4. The Commission emphasises the necessity for continuous and comprehensive research in the field of Agricultural Economics and recommends that all facilities should be provided for the Division of Agricultural Economics of the Commonwealth Department of Commerce and Agriculture so that it may advise the Government on matters concerning financial and economic policy in agriculture and inform the proposed independent authority on matters coming within that authority's scope.

5. The Commission, by a majority report, recommends the establishment of a National Council of Farmers and subsidiary organisations which it claims will be a new approach to the problem of policy-making and administration and an attempt to introduce economic democracy into Australian agriculture.

Some Comments

With respect to the first of the main problems discussed by the Commission and its recommendations arising therefrom, one must ask to what extent the different ends aimed at are mutually exclusive—will modified concessions in respect of Empire preference on specific export commodities, where the concession is least likely to involve sacrifice for Australia, materially assist to maintain or expand world trade? To what extent, furthermore, are international commodity agreements, in so far as they are successful in maintaining price levels, essentially restrictive. These are problems that, probably, can be most usefully discussed in the light of concrete instances, but the Commission's recommendations are not buttressed with any convincing arguments. With the Commission's recommendations regarding International Commodity Agreements the views expressed by Dr. G. L. Wood, in his article on "International Economic Collaboration" in the December, 1947, issue of the Economic Record make an interesting contrast.

Again, to the Commission's statement on page 69, that "It is felt that the United Kingdom is unlikely unless as a last resort, to use this method of bilateral balancing in order to expand reports. . .", one may point out that it is unlikely that the currency and other agreements that have been made by Britain with various countries in the postwar period, have not taken into account considerations as to possible effects on balance of payments. The agreement with Belgium, announced in the press on 18th March this year, may be quoted as a case in point.

Recommendations Practical

The Commission's recommendations seem to me, however, to have the merit of being realistic and based on present practical possibilities open to Australia within the sphere of world trade. The method of bargaining with respect to re-

ciprocal concessions for specific commodities is, in fact, the method that has been implemented at the recent trade conference at Geneva.

One subject on which the Commission is rather curiously silent is the exchange rate between Australia and the United Kingdom. Perhaps it felt that this subject was a study in itself or perhaps it merely decided to let sleeping dogs lie.

With respect to the other points enumerated above, space prevents any exhaustive comment or analysis and one is confined to the brief note that the second point regarding stable incomes for farmers, seems to be beset with some of the inherent difficulties of trying to have, at the same time, the best of two alternative worlds. The third proposal appears to have considerable merit in that the matters proposed to be dealt with by the tribunal have in the past often been treated in haste and in an atmosphere of pressure politics rather than on the most carefully collected information and in an earnest attempt to keep the welfare of the community the paramount consideration. On the fourth point, in view of possible doubt in some readers' minds as to whether a Government Department is the most suitable organisation for the collection of unbiassed and factual information as a guide to governmental policy-making, it may be pertinent for the present reviewer to merely quote from the foreword of the first issue of the Quarterly Review of Agricultural Economics issued by the Bureau of Agricultural Economics of the Commonwealth Department of Commerce and Agriculture, wherein the Minister states—"I would stress that the Bureau carries out its investigations quite independently, its purpose being to ascertain facts."

The Commission's recommendations in its final section regarding the organisation of the Farmers' Council are perhaps the most contentious portion as indicated by the fact that Professor Wadham dissented from these recommendations. The organisation proposed does undoubtedly sound rather grandiose and the experience with a somewhat similar body in Queensland, recounted by the Commission, is not encouraging. However, it appears certain that marketing of the agricultural commodities, if it develops along the lines suggested by the Commission, will not have success unless growers be accurately and continuously informed as to the how and why of what is done with their products and their co-operation obtained.

In conclusion, mention must be made of the valuable appendices which have been assembled, mainly by the labours of Messrs. C. L. Steele and K. J. Wallace, of the Commonwealth Department of Commerce and Agriculture (gratefully acknowledged by the Commission) and which contain concise and full information regarding Australian marketing organisation, financial assistance to primary producers 1920-45, the history of wheat stabilisation in Australia, potato marketing, and some methods for dealing with the problem of gluts.

F. O. GROGAN.

The attention of members is directed to the material assistance given by advertisers to the production of the Journal in its new form.

ANNUAL REPORT OF COUNCIL

Report of Council to the Twelfth General Meeting, held at the Shell Theatrette, Carrington St., Sydney, on 19th March, 1948.

Ladies and Gentlemen,

Your Council has pleasure in presenting its report for the year ending 31st December, 1947, that is to the end of the thirteenth year of Institute activity.

The office-bearers for the year were as follows:—

President: Mr. G. de V. Davis.

Hon. General Treasurer: Mr. F. C. McCleery.

Hon. General Secretary: Dr. F. T. Bowman.

Delegates:—

	Proxy.
Qld. Branch—	
Mr. D. O. Atherton	Dr. N. S. Noble, succeeded by Mr. J. M. Vincent.
N.S.W. Branch—	
Dr. E. T. Edwards.	
A.C.T. Branch—	
Mr. W. Hartley, succeeded by Mr. C. M. Donald.	Professor J. R. A. McMillan.
Vic. Branch—	
Mr. A. C. T. Hewitt.	Mr. H. J. Geddes, succeeded by Mr. R. Hayman.
Tas. Branch—	
Mr. L. W. Miller.	Mr. R. H. Anderson.
S.A. Branch—	
Mr. A. G. Strickland.	Mr. H. P. Brown.
W.A. Branch—	
Mr. H. Powell.	Mr. F. C. Butler, succeeded by Mr. E. J. Breakwell.

During the year Council has noted with pleasure the advancement of many members of the Institute, and has conveyed the congratulations of the Institute to the following members:—

Dr. N. S. Noble, on appointment as Editor of C.S.I.R. Journal of Scientific Research.
Mr. W. Poggendorff, on appointment as Chief, Division of Plant Industry, N.S.W. Dept. Agric.
Mr. A. V. Robinson, on appointment as Chief Chemist, N.S.W. Dept. of Agriculture.
Dr. H. J. Hynes, on appointment as Assistant Director, N.S.W. Dept. of Agriculture.
Dr. D. A. Herbert, on appointment as Associate Professor, Biology Dept., University of Qld.
Mr. H. P. Brown, on appointment as Chief, Div. of Information & Extension, N.S.W. Dept. Agric.
Prof. J. R. A. McMillan, on appointment as Treasurer, A.N.Z.A.A.S.

It is with deep regret that your Council records the death of *Mr. A. W. S. Moodie* (a Past President of the N.S.W. Branch) and who, at the time of his death, was Chief, Division of Plant Industry, N.S.W. Dept. of Agriculture.

Australian Medal of Agricultural Science.—Conditions having been agreed upon by Branches it was decided to institute an annual award of a medal for distinguished services to agriculture and nominations were called for the first award to be made at the twelfth General Meeting.

Interchange of Personnel.—The need for restoration of the pre-war policy of freedom of interchange for scientific agricultural personnel was brought to the notice of the Prime Minister and State Premiers. The support of professional bodies and associations is being enlisted in furtherance of this objective.

Salary and Status.—A compilation of the salary ranges applying at various institutions in the Commonwealth showed a wide divergence among themselves and from the Institute Schedule of 1945. Exploring what action could be taken in the interest of members, the Institute ascertained, on legal advice, that in all probability it would be unable to obtain registration for appearance before the Commonwealth Arbitration Court. The survey, however, has been successfully utilised by some groups of members in obtaining improvements in salary and a

further collation of salary ranges is being made in order that the Institute shall continue to have complete co-ordinated information on this question, upon which further action may be taken.

Improved Training in Horticulture.—A proposal, originating from the Tasmanian Branch for improved training in horticulture was submitted to Branches and their views embodied in a report by a Council sub-committee. On the text of this report, it was decided to draw the attention of the Universities to the desirability of certain improvements in horticultural training for students wishing to make their career in this field of agriculture. It was also decided to draw to the attention of State Departments of Agriculture not providing a Diploma Course in Horticulture, the desirability of providing such a curriculum at Agricultural Colleges, of a standard equal to the Diplomas of Agriculture and Dairying.

Co-ordination of Research.—An advisory Committee on the Co-ordination of Agricultural Research was set up in New South Wales during the past year, largely owing to the representations of the New South Wales Branch. Other Branches reported that there appeared to be little need for a corresponding body in their domain.

Membership.—The above table shows the number of admissions, transfers, and cancellations during the year 1947, as well as the totals for corporate and student membership as at 31st December, 1947.

Branch	Admissions.	Transfer Gains.	Transfer Losses.	Cancels. and Resigns.	Audited corporate membership.	Audited student membership.
Qld.	6	1	2	—	68	—
N.S.W.	11	4	6	2	185	85
A.C.T.	2	5	—	—	48	—
Vic.	13	1	1	1	167	4
Tas.	1	2	1	—	24	—
S.A.	10	—	3	—	79	20
W.A.	—	—	—	—	72	21
TOTALS	43	13	13	3	643	130

The Qualifications Committee.—Composed of *Messrs. A. J. Vasey* (Convener), *A. J. Aird* and *G. W. Leeper,* has continued to render considerable assistance to Council, by its investigation of all applications for membership.

Institute Journal.—In an effort to overtake delays in printing due to industrial disturbances which have affected the printing trade in New South Wales, Nos. 1 and 2 of the Journal were combined in a single issue during the year, the remaining numbers being issued separately. The personnel of the Journal Committee, consisted of *Mr. D. B. Adam* (editor), *Dr. C. S. Piper* (business manager), *Dr. Marshall,, Mr. K. Woodroffe* and *Dr. H. G. Andrewartha* (up to his time of departure overseas). As an offset to the increasing printing charges it was decided to re-introduce advertising into the Journal, this to take effect in 1948.

Branch Activities.—Branch meetings continue to be a feature of Institute activity and the Victorian Branch held a Refresher Course in Agriculture of one week's duration. Besides holding meetings for the discussion of topics of current agricultural interest, Branches have been called upon to devote a good deal of time to business originating from general meetings of the Institute.

Tenth General Meeting.—This meeting was held on 21st March, 1947, for the transaction of formal Institute business, namely, to receive the Reports of Council and of the Editor and Business Manager of the Journal, the statement of accounts and balance sheet, and the report of Council concerning the election of President. *Mr. G. De V. Davis* was installed as President and *Dr. B. T. Dickson* de-

The Australian Institute of Agricultural Science

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1947.

1946.				1947.			1946.				1947.		
£8	8	0	To Audit Fees	£10	10	0				By Subscriptions Received—			
46	2	3	„ Council Meeting Expenses	90	3	0	£143	11	0	Victorian Branch ..	135	3	0
298	19	5	„ Cost of Journal	315	10	3	178	10	0	N.S.W. Branch ..	193	5	0
			„ General Meeting Expenses—				68	7	0	S.A. Branch	84	0	0
			10th General, Sydney .. £12 7 9				48	6	0	Queensland Branch ..	58	16	0
47	15	5	11th General, Perth .. 72 3 5				77	16	0	W.A. Branch ..	64	12	6
				84	11	2	35	14	0	A.C.T. Branch ..	33	12	0
—			„ Legal Expenses	17	6	0	24	3	0	Tasmanian Branch ..	25	9	0
36	1	3	„ Petty Cash and Incidentals	22	12	1							£594 17 6
34	0	9	„ Printing and Stationery	37	8	0	13	0	0	„ Interest Received			13 0 0
			„ Grants to Branches—										
37	10	0	Victoria .. —				£589	7	0	„ Total Income for the year			£607 17 6
54	12	0	New South Wales .. —				51	16	1	„ Deficit for the year ..			—
19	10	0	South Australia .. —										
13	9	6	Queensland —										
28	15	6	Western Australia —										
9	18	0	A.C.T. .. .. —										
6	1	0	Tasmania .. —										
				—									
£641	3	1	„ Total Expenditure for the year	£578	0	6							
	—		„ Surplus for the year ..	29	17	0							
£641	3	1		£607	17	6	£641	3	1				£607 17 6

BALANCE SHEET AS AT 31st DECEMBER, 1947.

LIABILITIES.

1946.				1947.		
£165	6	0	Sundry Creditors	£127	16	0
16	16	0	Subscriptions paid in advance	24	3	0
			Accumulated Fund—			
			Balance at 31/12/46 .. .. £737 6 9			
737	6	9	**Add** Surplus for year ended 31/12/47 .. .. 29 17 0			
				767	3	9
£919	8	9		£919	2	9

ASSETS.

1946.				1947.		
			Cash at Bank and in Hand—			
			Sydney £458 11 8			
			Adelaide 45 16 4			
£508	1	3	Petty Cash .. 3 7 3			
				£507	15	3
			Commonwealth Govt. Bonds—			
			3½%— 15/8/1956 .. £100 0 0			
			3½%— 15/11/1958.. 100 0 0			
400	0	0	3½%— 15/9/1959 — 200 0 0			
				400	0	0
11	7	6	Office Furniture	11	7	6
£919	8	9		£919	2	9

Prudential Building,
39 Martin Place,
SYDNEY. 17/2/48.

The above Balance Sheet has been prepared from the Books of Account, Accounts and Vouchers of the Australian Institute of Agricultural Science, and is a correct statement of the position of the Institute's affairs on the 31st December, 1947, as disclosed thereby.

HORLEY & HORLEY,
Chartered Accountants (Aust.)

livered the Presidential Address entitled "Two Decades—a Review of the Agricultural Set-up 1926-1946."

Eleventh General Meeting.—This meeting was held on 18th-19th August, 1947, at Gleddon Building, Perth, immediately prior to the meeting of A.N.Z.A.A.S. The President and Hon. General Secretary also acted as delegates of the Institute to the General Council and Section K of A.N.Z.A.A.S.

Resolutions from General Meetings.—Council sub-committees were appointed to make the necessary investigations required by certain resolutions from the Perth Meeting as follows:—

A Committee, composed of South Australian members, with *Professor H. C. Trumble* as convener; on new publications, such as the Australian Journal of Agricultural Science and Agricultural News Magazine.

A Committee of Victorian Branch members, with *Mr. A. C. T. Hewitt* as convener; on survey of scholarship and post-graduate study facilities and an investigation into concessions for Interstate study and experience.

A Committee of N.S.W. Branch members, with *Professor McMillan* as convener; association of the Institute with the Agriculture and Forestry section of A.N.Z.A.A.S.

In implementation of another of the objects of association the Institute maintained its relationship with a number of other professional and scientific bodies such as A.N.Z.A.A.S., Australian Chemical Institute, Australian Veterinary Association, and is represented on the Joint Standing Committee of Professional and Scientific Societies, Victoria, by *Dr. H. Forster*. This body has approached the Commonwealth Government for an increase of research grants to Universities and income tax concessions for persons studying abroad. In the matter of the freedom of interchange of personnel, the Institute has sought the co-operation of some 20 organisations.

On matters pertaining more to its internal administration, a Council Sub-Committee (Hon. General Treasurer, convener) has examined the financial position and prospects of the Institute and recommended the abolition of rebates commencing 1947; draft rules for the uniform guidance of branch secretaries and treasurers have been drawn up; arrangements have been made for the printing of the membership list and measures were taken designed to further interest students in the Institute. Council approved of the payment of rebates to Branches for the year 1946 at the usual rates, viz., 5/6 for each financial corporate member, and 2/6 for each financial student member.

The Institute has taken successful action in refuting charges against a member.

Finance.—The Audited Statement of Accounts, shows that income increased from £589 in 1946 to £607 in 1947, due to an increase of £18 in receipt from subscriptions. Expenditure decreased from £641 in 1946 to £578 in 1947; increases in expenditure under the headings of Council Meetings (£44), General Meetings (£37) and Journal (£17) were more than counterbalanced by the omission of Grants to Branches (£170). The excess of income over expenditure was £29 in 1947 as compared with a deficit of £51 in 1946. At the end of 1947, the Accumulated Fund of the Institute amounted to £767.

For and on behalf of the Council,

G. DE VAHL DAVIS,
President.

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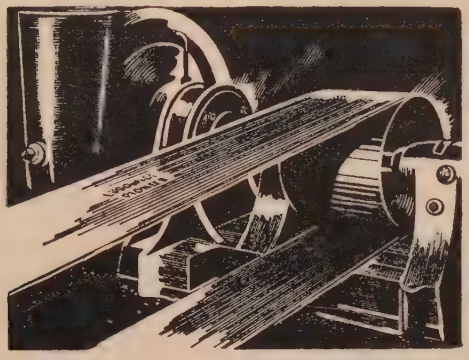

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THE NEW PRESIDENT

The new President of the Australian Institute of Agricultural Science is *Mr. Arthur F. Bell,* who is the Under Secretary of the Queensland Department of Agriculture and Stock.

(A. F. Bell)

Arthur Bell did not commence his University education until after the first World War in which he served with the 46th Battery of Field Artillery, A.I.F. On his return to Australia he attended Queensland University where he graduated in the Faculty of Science.

He was awarded a travelling scholarship in Plant Pathology during the currency of which he attended the University of California College of Agriculture where he obtained his M.Sc. He attended the Imperial College of Science and Technology in London, taking his D.I.C.

On returning to Australia Mr. Bell joined the staff of the Bureau of Sugar Experiment Stations as Pathologist, later becoming Assistant Director and ultimately Director.

During the war acted as the State Executive Officer of the War Agricultural Organisation.

He also holds the positions of Member of Council of the C.S.I.R., Member of Commonwealth Standing Committee on Agriculture, Chairman of the State Committee of C.S.I.R., Deputy Chairman of the Bureau of Investigation of Land and Water Resources, Chairman of the State F.A.O. Committee, Member of the Queensland Bureau of Industry.

Represented the Queensland University at the International Botanical Conference at Ithaca, New York, in 1927, and represented Queensland at the International Conference of Sugar Cane Technologists held in Puerto Rico in 1932.

General Secretary of the International Society of Sugar Cane Technologists 1932-5, President, Queensland Society Sugar Cane Technologists 1941-6, Chairman, International Committee on Sugar Cane Diseases 1932-8.

EDITOR'S THANKS

From the Hon. Editor's Report of Volume 13 *to the Council.*

"In concluding this report I wish to express regret that the pressure of other duties and responsibilities compelled me to offer my resignation with the completion of Volume 13. In resigning this position I should like to thank the Council for the honour reposed in me and to thank *Dr. Piper,* as Business Manager, and other colleagues on the Publications Committee for their active support in what has been an arduous task. I would also like to thank colleagues who act as hon. sub-editors in the various branches. Theirs is not an easy task but it is on their activity that the success of the Journal depends. I must also record our appreciation of the fine work done on our behalf by the Australian Medical Publishing Co. in the actual production of the Journal." D. B. ADAM.

COUNCIL PROCEEDINGS

March Meeting

A special meeting of Council was held on *Friday, 19th March,* 1948, in Dr. Bowman's office, Department of Agriculture, Sydney. This meeting was called at the request of the Victorian delegate, *Mr. A. C. T. Hewitt,* to discuss business connected with the transfer of the Journal to Victoria.

Mr. Hewitt presented proposals from his Branch involving a new format for the Journal, a higher rate of advertising and the publication of the Journal in Melbourne. After considerable discussion, the proposals of the Victorian Branch were approved, including the quote submitted by Ramsay, Ware Publishing Pty. Ltd., 117 King Street, Melbourne, for publishing the Journal.

Publications Committee:

The following members of the Publications Committee were appointed, with duties commencing with the preparation and publication of the June issue, 1948.

Editor: Mr. A. Shavitsky, Research Secretary, University of Melbourne.

Business Manager: Mr. W. J. Webb, Manager, Agricultural Chemicals Section, I.C.I.A.N.Z.

Assistant Business Manager: Mr. P. T. Mitchell, Fertiliser Controller, Department of Commerce and Agriculture.

Committee:

Mr. J. A. Baker, Editor, Stock and Land, and the Victorian Dairy Farmer.

Mr. R. D. Croll, Chief Executive Officer, Development Division, Drug Houses of Australia.

Dr. H. C. Forster, Assistant Secretary, C.S.I.R.

Dr. N. S. Noble, Editor, C.S.I.R.

Membership: Mr. A. Shavitsky was admitted to Corporate Membership.

April Meeting

A meeting of Council was held at Science House, Gloucester Street, Sydney, on *Thursday, 8th April,* 1948.

Executive Appointments:

Mr. L. F. Mandelson was appointed Hon. Gen. Secretary and Mr. F. C. McCleery was re-appointed as Hon. Gen. Treasurer.

Constitution of Council:

Advice was received regarding the appointment of the following principal delegates:—

Dr. T. H. Harrison (A.C.T.), Dr. E. T. Edwards (N.S.W.), Professor H. C. Trumble (S.A.) and Mr. A. R. Brimblecombe (Qld.);

also regarding the following proxy delegates:—

Professor J. R. A. McMillan (A.C.T.), Messrs. J. M. Vincent (Qld.), H. P. Brown (S.A.), R. H. Anderson (Tas.), R. H. Hayman (Vic.) and E. J. Breakwell (W.A.).

Award of Merit:

A Sub-Committee of three, Dr. E. T. Edwards, Professor J. R. A. McMillan and Mr. G. de Vahl Davis was appointed to examine the rules and procedure for the award of the Medal.

Interchange of Personnel:

It was resolved:—

"That the offer of the Australian Chemical Institute as convener of the Australian Association of Scientific Bodies, to convene a meeting of all bodies interested in the 'interchange of scientific personnel' with a view to taking joint and concerted action be adopted; and that bodies to whom the Institute wrote concerning the matter be advised and asked to co-operate with the Australian Association of Scientific Bodies."

Membership—Transfers:—

The following transfers were noted:—

Mr. F. S. I. Newman, from S.A. to Vic.
Mr. W. D. Hardy, from N.S.W. to A.C.T.
Mr. W. C. Duggan, from N.S.W. to A.C.T.

May Meeting

A meeting of Council was held at Science House, Gloucester Street, Sydney, on *Friday, 28th May*, 1948.

Constitution of Council:

Advice was received of the appointment of the following principal delegates:

Messrs. E. F. Fricke (Tas.), P. T. Mitchell (Vic.) and G. F. Melville (W.A.). The appointment of Mr. G. de Vahl Davis as proxy delegate for South Australia vice Mr. H. P. Brown was noted.

Membership:

Having received the recommendation of the Branch submitting the application, and of the Qualifications Committee, the following applicants were approved for Corporate Membership:—

Harvey, R. G. M. (S.A.).
Plush, D. S. (S.A.).
Coombe, B. G. (S.A.).
Eggleston, Miss M. P. (Vic.).
Fitzsimmons, R. W. (N.S.W.).
French, R. J. (S.A.).
Friend, T. E. (N.S.W.).
Gellatley, J. G. (N.S.W.).
Hudson, W. J. C. (N.S.W.).
Leske, K. B. (S.A.).
Meadley, D. R. (Vic.).
Moore, A. W. (S.A.).
Mullett, J. T. (N.S.W.).
Purss, G. S. (N.S.W.).
Russell, J. S. (S.A.).
Stewart, J. D. (Vic.).

The following were approved for Student Membership (all N.S.W. Branch)

Bloch, R. W.
Campbell, Miss M. J.
Colwell, J. D.
Condon, T. F.
Darley, E. C.
Frazier, A. K.
Garrett, J.
Harris, R. W.
Ireland, G. R.
Kingham, I. A.
Latter, B. D. H.
McHugh, L. J.
Mears, A. D.
Meers, J.
Morrison, A. K.
Passey, R. F.
Peterson, A. S.
Philpotts, Miss H.
Potter, J. N.
Potter, R. A.
Pulling, H. L.
Roberts, E.
Robertson-Cunningham, R. C.
Saville, S. P.
Storrier, R. R.
Upton, Miss M. I.
Vane, N. W.
Walker, Miss D. E. H.
Walker, J.
Wright, P.

The following *transfers* were noted:—

Mr. S. G. Gray, from A.C.T. to Qld.
Mr. G. D. Hubble, from Tas. to Qld.
Mr. T. H. Strong, from S.A. to A.C.T.

The married name of Miss J. Demaine (Mrs. J. Robertson) was noted.

Re-appointment of Qualifications Committee:

Messrs. A. J. Vasey (Convener), J. A. Aird and G. W. Leeper, were re-appointed as Qualifications Committee for the ensuing year, such appointment to be retrospective to last Council Meeting.

Thirteenth General Meeting:

The Principal delegates, having expressed assent to the holding of a Regular General Meeting in Hobart, in conjunction with a meeting of A.N.Z.A.A.S., it was resolved:—

"That notwithstanding Rule 1 of the 'Rules and Standing Orders for General Meetings,' the Thirteenth General Meeting of the Institute shall take place in Hobart on 10th and 11th January, 1949, and shall include the business of a Regular General Meeting."

The President, Hon. General Treasurer and Hon. General Secretary, were appointed delegates of the Institute to Council of A.N.Z.A.A.S. for the meeting to be held in Hobart from 12th to 19th January, 1949.

BRANCH NOTES

AUSTRALIAN CAPITAL TERRITORY

The 70th General Meeting of the A.C.T. Branch was held on 24th March, 1948, when Mr. L. D. Pryor addressed the meeting on "City Vegetation." Mr. Pryor, who is Director of Parks and Gardens, Canberra, recently returned from a visit to Europe, Africa and America. His address was based on a series of coloured photographs taken in Stockholm, Paris, Versailles, Florence, Madrid, Morocco and various centres in the United States of America.

The use of evergreens in the southern countries of Europe and of deciduous trees in the north for city beautification was illustrated in the photographs. Trends from the treeless older established sections of the cities, to formal tree plantings and more modern informal designs were shown.

The 71st General Meeting of the Branch was held on 13th May, 1948, when Mr. F. W. Bulcock, Director-General of Agriculture, spoke on "International Aspect of Agriculture."

QUEENSLAND

The Thirteenth Annual General Meeting of the Branch was held on 24th March, 1948.

The Annual Report for the preceding year showed that the Branch membership was 67. Eight new members were admitted. Financially the Branch is in a good position with a credit balance of £73, but the cessation of rebates on membership fees will probably make the reintroduction of the Branch fee necessary.

Appreciation was expressed at Professor Teakle's generosity in donating an annual prize to be awarded by the Branch. At the donor's request it will be known as the "Sutton Prize in Agriculture" in honour of Dr. George L. Sutton. The award will be made to the undergraduate who presents the best paper on a topic of agricultural science selected by the candidate.

The following office-bearers were elected for the ensuing year:—

President: Mr. A. R. Brimblecombe.

Vice-Presidents: Messrs. D. O. Atherton and C. W. Winders.

Hon. Secretary-Treasurer: Mr. F. Chippendale.

Hon. Sub.-Editor: Mr. C. G. Hughes.

Committee Members: Professor L. J. H. Teakle, Messrs. P. J. Skerman and N. R. Caldwell.

In lieu of the Presidential address there were two exhibits for discussion by members. Mr. W. J. S. Sloan showed some tubers which had been damaged by nut grass (*Cyperus rotundus*). Mr. J. N. Smith exhibited specimens of Coreid bugs which are frequently concerned in the shedding of young fruit.

NEW SOUTH WALES

At the Annual General Meeting of the Branch held at Science House, Sydney, in February, Mr. W. Poggendorf, Chief of the Division of Plant Industry, N.S.W. Department of Agriculture, delivered the Presidential address. The subject was "A Review of the Vegetable Oil Position," and the text of this address has been published as an article in the March, 1948, issue of this journal.

A general meeting was held on 23rd April, at which Messrs. E. J. Breakwell and R. R. Pennefather spoke on "A Policy for Rural Extensions."

An article based on these addresses will appear in the next issue of the journal.

TASMANIA

At the Annual Meeting of the Tasmanian Branch, the following officers were elected for the ensuing twelve months:—

President: Mr. E. F. Fricke.

Vice-President: Mr. W. F. Walker.

Secretary: Mr. G. C. Wade.

Treasurer: Mr. J. R. Rayner.
Sub-Editor: Mr. T. D. Raphael.
Publicity Officer: Mr. J. T. Gemmell.
Committee Members: Messrs. L. W. Miller and F. E. Ward.

VICTORIA

The Thirteenth Annual General Meeting of the Branch was held on 7th May, 1948.

The Annual Report showed that Branch Membership was 165 corporate and 3 student members—a net gain of 17 members.

The Refresher Course, conducted at the Melbourne University during the week —27th to 31st October, 1947—was highly successful and was attended by 79 members.

The Victorian Branch has accepted Council's invitation to take over the publication of the Journal.

The following office-bearers were elected for the ensuing year:—
President: Mr. P. T. Mitchell.
Vice-President: Mr. W. D. Andrew.
Immediate Past President: Mr. A. C. T. Hewitt.
Hon. Secretary: Mr. L. L. Stubbs.
Hon. Assistant Secretary: Mr. H. Freeman.
Hon. Treasurer: Mr. T. Hogan.
Hon. Sub.-Editor: Mr. A. J. McIntyre.
Committee Members: Professor S. M. Wadham, Messrs. E. J. Thomas and J. A. Baker.

The Presidential address, entitled "Better Farming Through Live Stock," was delivered by Mr. A. C. T. Hewitt.

SOUTH AUSTRALIA

The Thirteenth Annual General Meeting of the Branch was held on 6th April, 1948.

The Annual Report for the preceding year showed that the Branch membership was 77 corporate and 20 student members. Branch fund deteriorated during the year. A credit balance of £7/19/4 during the twelve months had changed to a debit of £2/10/8. To meet the position caused by the discontinuance of rebates from Council, a Branch levy of 9/- per corporate member has been introduced from the beginning of 1948.

The following office-bearers were elected for the ensuing year:—
President: Professor H. C. Trumble.
Hon. Secretary: Mr. C. Williams.
Hon. Treasurer: Mr. K. Woodroffe.
Hon. Sub-Editor: Mr. D. B. Williams.
Committee Members: Dr. A. T. Ballard, Messrs. H. K. Kemp, R. N. McCulloch and D. S. Riceman.

Mr. A. G. Strickland, retiring President, becomes Vice-President.

The Presidential address was given by Mr. A. G. Strickland, who described the fruit fly outbreak in South Australia and the measures taken to control it. This will form an article for a later issue of the journal.

WESTERN AUSTRALIA

The Thirteenth Annual General Meeting of the Branch was held on 30th April, 1948.

Business was confined to the presentation of the reports from the Secretary and Treasurer and the election of office-bearers for the ensuring twelve months.
President: Mr. G. F. Melville.
Vice-President: Mr. A. S. Wild.
Hon. Secretary: Mr. H. G. Cariss.
Hon. Treasurer: Mr. F. O. Grogan.
Hon. Sub-Editor and Publicity Officer: Mr. E. R. Watson.
Committee Members: Professor E. J. Underwood, Messrs. I. P. Bonnerup, L. C. Lightfoot and R. Smith.
Immediate Past President: Mr. H. R. Powell.

Following upon the meeting a Branch dinner was held, to which representatives of a number of fellow professional bodies were invited. It was a particularly successful event and promises to develop into an annual Branch dinner.

GENERAL

INCREASE IN STUDENT NUMBERS

The student numbers enrolled in Agricultural Science courses at the various Australian Universities have shown a steep rise since the war, as have numbers in all other faculties. But, whereas in nearly all other faculties the maximum first-year enrolment was in 1947, Queensland, Sydney and Western Australia have had even heavier enrolments in 1948. It is expected that numbers will begin to decline in 1949, but will probably be greater than pre-war figures.

Table showing Numbers of Students enrolled in Agricultural Science Courses at Australian Universities.

Name of University	First Year		Second Year		Third Year		Fourth Year		Fifth Year Honours		Total	
	*	†	*	†	*	†	*	†	*	†	*	†
Adelaide	11	6	27	8	7	2	9	—	—	—	54	16
Melbourne	36	17	44	25	39	29	28	4	—	—	147	75
Queensland	22	—	11	—	9	—	4	—	—	—	46	20
Sydney	61	19	49	21	50	22	38	5	8	4	206	71
West Australia	43	11	34	13	10	6	11	1	4	1	102	32
											555	214

(*) Total number of students in each year.
(†) Number of ex-servicemen in each year.

GRADUATES PLAY SAFE

The following remarks were made by Professor S. M. Wadham at the Twelfth Annual General Meeting this year when he received the Australian Medal of Agricultural Science.

"One problem worries me. Our young graduates are so desperately keen to play safe. I suggest that if agriculture is to progress and if the service of scientists to agriculture is going to progress, then each and every young graduate, when he starts, should not be thinking so much about what is going to happen if he takes this or that job or what will be the prospects in five years' time. My experience is that that sort of forecast looks important at the moment but, in actual fact, is fatuous. I believe there are always numbers of jobs in which a man can prove his capacity provided he himself has the courage and determination to do his best in the job he chooses. New opportunities are always developing for those who have proved their ability. There seems to be a lack of courage today, maybe brought about by memories of the depression. I suggest that it is impossible for anybody to assess what is likely to happen in five years' time in any job. The progress graduates make will be determined by the amount of energy and determination which they put into their work. I believe in a free system of opportunity for all, but if you are going to have a free system, the people concerned must have courage and energy if they are going to make progress themselves and in their work."

AWARD OF MERIT

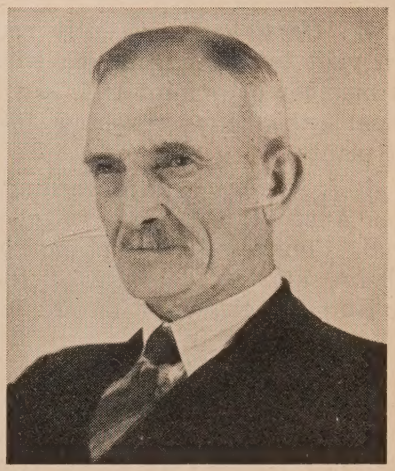
The first award of the Australian Medal of Agricultural Science was made to Professor Wadham at the Twelfth General Meeting of the Institute. The Award is for distinguished service to Agriculture.

Professor Samuel McMahon Wadham came to Australia from Cambridge University in September, 1926, and since then has occupied the Chair in Agriculture at Melbourne University. Since Professor Wadham came to Australia his advice has been sought by various government departments, organisations and individuals, and on numerous occasions his wide experience and understanding has been used to help formulate national agricultural policy.

In 1928, he made an investigation into technological aspects of the dairying industry in the eastern States of the Commonwealth for the Council of Scientific and Industrial Research. In 1929, he was appointed by the Victorian Government to a Committee which was asked to determine Home Maintenance Areas of wheat and sheep farms in the Victorian Mallee.

In 1932, under his direction, the School of Agriculture commenced a series of district surveys into farming practices and land use. In 1934, he was appointed a member of the Commonwealth Royal Commission into the Wheat, Flour and Bread Industries. This work fully occupied his time for two years. In 1936 he became a member of the Nutrition Advisory Committee of the National Health and Medical Research Council. In 1939 "Land Utilisation in Australia," by Wadham and Wood, was published.

In February, 1943, he was appointed a member of the Rural Reconstruction Commission under the Department of Post-War Reconstruction. The Commission travelled widely over the Commonwealth, taking evidence, and has published ten reports. Since 1941, under Professor Wadham's general direction and inspiration, a series of studies have been made by the School of Agriculture on conditions of life in the country. In 1946-47, he was a member of a Commonwealth Economic Investigating Committee on the use of the waters of the Snowy River.



Professor S. M. Wadham

He is a member of the Victorian State Committee of the Council for Scientific and Industrial Research. As well as his University duties connected with the Chair of Agriculture, he has held the position of Chairman of the Professorial Board. He is also Australian Liaison Officer for appointments to the British Colonial Service.

In 1946, he was invited to give the Joseph Fisher Lecture at the Adelaide University, and in 1947, he was awarded the Farrer Memorial Medal for distinguished agricultural research and gave the Farrer Oration.

Professor Wadham is well known as a writer and for his many broadcasts. He has taken a very active part in several societies including the Victorian Chamber of Agriculture, of which he is President, the A.I.A.S., the Melbourne University Agricultural Society, the Standards Association, and the Australian-New Zealand Association for the Advancement of Science.

PERSONAL

Australian Capital Territory.

Dr. J. G. Bald has resigned from the Institute to take up the position of Associate Professor of Pathology, University of California, Los Angeles.

Mr. W. Hartley has recently returned from a visit to South America where he was a member of a joint U.S.-Australian botanical expedition searching for new fodder plants.

Dr. A. J. Nicholson is proceeding overseas, as Australian delegate to the International Congress of Entomology at Stockholm, and as delegate to the Imperial Entomological Conference in London.

New South Wales

Emeritus Professor R. D. Watt, formerly Dean of Faculty of Agriculture at Sydney, has recently returned from his visit to the United Kingdom. He was absent for about one year, during which time, he saw much of agriculture in Britain and other countries.

Mr. W. D. Hardy, formerly Agronomist with the N.S.W. Department of Agriculture, has transferred to the Commonwealth Bureau of Agricultural Economics.

Mr. H. R. Richardson, N.S.W. Department of Agriculture, has been appointed to the position of Deputy-Principal, Hawkesbury Agricultural College.

Mr. John Douglass, Director of Rural Broadcasts, A.B.C., Sydney, has returned from America. During his visit he recorded a number of interviews with well-known agricultural authorities.

Mr. S. C. Graham, of Gillespie Bros.' Flour Mills, and *Mr. M. V. O'Reilly,* of Birds' Eye Foods (Aust.), both visited the United States during the past year.

Mr. F. Filan, formerly Agronomist, N.S.W. Department of Agriculture, has been appointed as Manager of the Department's Experiment Farm at Bathurst.

Tasmania

An informal farewell was given to *Mr. G. D. Hubble,* of the C.S.I.R., who has been transferred to work at the Regional Pasture Laboratories at Toowong, Queensland. Mr. Hubble has been engaged during the last few years in soil survey work in the northern part of the State.

Victoria

Associate Professor G. W. Leeper has been given a Carnegie grant to go abroad for about ten months. He will leave at the end of second term to study soil science in California, and will later visit Canada, Great Britain and Europe.

Mr. F. M. Reid left for England in May to investigate matters of interest to the horticultural industries of Victoria. He will be away for about six months and will return through Canada and U.S.A.

Mr. M. Rothberg has recently been awarded the degree of Doctor of Philosophy in the University of North Carolina, U.S.A. His thesis was entitled "Victorian Dairy Farms—A sociological survey."

Western Australia

Mr. G. K. Baron Hay, Under-Secretary for Agriculture, has been seconded to the Land Settlement Board as Chairman. The Chief Inspector of Stock, Mr. A. McKenzie Clark, has been appointed Acting Under-Secretary for Agriculture in his absence.

Mr. A. J. Marshall, formerly Agricultural Adviser in the West Australian Department of Agriculture, has been appointed Lecturer in Agriculture at the Muresk Agricultural College.

Mr. G. R. W. Meadly, Assistant Government Botanist, has been awarded the degree of Master of Science in the University of W.A. His thesis was entitled "Investigations into the 'Stalling' of Subterranean Clover in the Lower Rainfall Pasture Belt of W.A."

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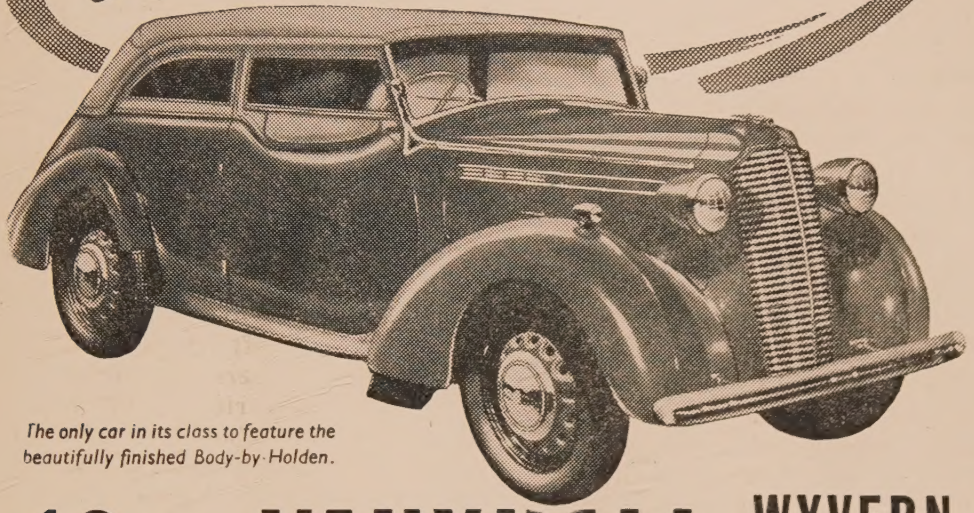

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Printed for the Australian Institute of Agricultural Science by Ramsay, Ware Publishing Pty. Ltd., 129 King Street, Melbourne.